DOE/RL-2015-23
Revision 0

Remedial Design/Remedial Action Work Plan for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

U.S. DEPARTMENT OF ENERGY | Richland Operations Office

P.O. Box 550
Richland, Washington 99352

DOE/RL-2015-23
Revision 0

Remedial Design/Remedial Action Work Plan for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units

Date Published
May 2016

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

U.S. DEPARTMENT OF ENERGY | Richland Operations Office
P.O. Box 550
Richland, Washington 99352

APPROVED
By Julia Raymer at 9:58 am, May 18, 2016

Release Approval Date

Printed in the United States of America

Signature Sheet

Title DOE/RL-2015-23, *Rev 0, Remedial Design/Remedial Action Work Plan for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*

R. J. Corey

U.S. Department of Energy, Richland Operations Office

Signature — 5/19/16 Date

E. Laija

U.S. Environmental Protection Agency

Signature — 5/19/2016 Date

This page intentionally left blank.

Executive Summary

Final remedial actions (RAs) were selected for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Source Operable Units (OUs) in accordance with the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*;[1] the Tri-Party Agreement (Ecology et al., 1989a, *Hanford Federal Facility Agreement and Consent Order*);[2] and 40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan."[3] The RAs are described in EPA et al., 2011, *Record of Decision Hanford 200 Area Superfund Site 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*,[4] hereinafter called the record of decision (ROD). The purpose of the RAs is to address source contamination that poses threats to human health and the environment.

This remedial design/remedial action work plan (RD/RAWP) supports implementation of RAs established in the ROD (EPA et al., 2011) within the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Source OUs. The selected remedy for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs addresses soils and subsurface disposal structures, two settling tanks, and associated pipelines contaminated primarily with plutonium and cesium. Structures and other debris that must be removed in order to conduct required remediation will be excavated. This RD/RAWP establishes the general size, scope, and character of the RA project and identifies the technical requirements of the RAs.

The ROD (EPA et al., 2011) identified specific pipeline waste sites associated with soil waste sites and structures in the 200-CW-5, 200-PW-1, and 200-PW-6 OUs that are to be remediated. Several of these pipeline waste sites originate from buildings associated with the Plutonium Finishing Plant (PFP) complex including the 231Z, 234-5Z, 236Z, and 241Z Buildings. Segments of the pipeline waste sites originating at these buildings are co-located with other waste sites (including pipelines, unplanned release sites, and disposal sites) for which remedial alternative evaluations and decisions have not

---

[1] *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, 42 USC 9601, et seq., Pub. L. 107-377, December 31, 2002. Available at: http://epw.senate.gov/cercla.pdf.

[2] Ecology, EPA, and DOE, 1989a, *Hanford Federal Facility Agreement and Consent Order*, 2 vols., as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington. Available at: http://www.hanford.gov/?page=81.

[3] 40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," *Code of Federal Regulations*. Available at: http://www.gpo.gov/fdsys/pkg/CFR-2010-title40-vol27/xml/CFR-2010-title40-vol27-part300.xml.

[4] EPA, Ecology, and DOE, 2011, *Record of Decision Hanford 200 Area Superfund Site 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0093644.

been made. To develop a consistent remedial approach to these co-located waste sites, U.S. Department of Energy (DOE) is proposing to transfer those segments, currently in the 200-CW-5, 200-PW-1, and 200-PW-6 OUs, into the OU in which the other co-located waste sites will be evaluated and remediated.

The RAs include maintaining and enhancing the existing soil cover for the 200-PW-3 OU; removal, treatment (as needed), and disposal (RTD) for the 200-CW-5, 200-PW-1, and 200-PW-6 OUs; installation of evapotranspiration barriers over the 200-PW-1 and 200-PW-6 OU soil sites; completion of soil vapor extraction (SVE) system operations; and institutional controls (ICs).

Maintaining and enhancing the existing soil covers will be used to provide coverage to a depth of at least 4.6 m (15 ft) over cesium-contaminated soils. This consists of enhancing the existing soil cover with additional backfill, where necessary, to provide a minimum of 4.6 m (15 ft) of soil cover at each of the waste sites and then maintaining the soil cover. The 200-PW-3 OU, also known as the Cesium-137 Waste Group, will require that three of the five waste sites receive additional backfill to achieve coverage of at least 4.6 m (15 ft) depth. Contamination at the other two waste sites is deeper than 4.6 m (15 ft) from the ground surface and will not require additional backfill.

RTD of soil and debris to the specified depths or specified cleanup levels will be used to address plutonium-contaminated soils and subsurface structures and debris. This consists of (1) removing a portion of contaminated soil, structures, and debris; (2) treating these removed wastes as required to meet disposal requirements at the Environmental Restoration Disposal Facility (ERDF), which is located on the Hanford Site, or waste acceptance criteria for offsite disposal at the Waste Isolation Pilot Plant (WIPP); and (3) disposal at ERDF or WIPP. The selected pipelines associated with these OUs will also be excavated and disposed at ERDF or WIPP. The remedy for some of the 200-CW-5, 200-PW-1, and 200-PW-6 pipeline waste sites will also require remediation of portions of pipelines in the 200-IS-1 OU and portions of a soil waste site in the 200-WA-1 OU. DOE will coordinate these actions with EPA to ensure no orphaned waste sites are created.

The RTD approach will be applied to the following:

- **200-CW-5 OU, also known as the Z-Ditches.** The contaminated soils and debris that exceed cleanup levels will be excavated to a depth of 4.6 m (15 ft) below ground surface (bgs) with disposal at ERDF or WIPP, as appropriate. The excavation area will be sampled in accordance with the sampling and analysis plan (SAP[5]), backfilled, and revegetated.

- **Three of the six 200-PW-1 OU waste sites, also known as the High-Salt Waste Group.** The contaminated soils and debris will be excavated to a minimum of 0.6 m (2 ft) below the bottom of the disposal structure (6.1 to 7 m [20 to 23 ft] bgs), with disposal at WIPP or ERDF, as appropriate. The excavation area will be sampled in accordance with the SAP (DOE/RL-2015-22) and backfilled. After the excavations are filled, an evapotranspiration barrier will be constructed over the remaining waste in these waste sites.

- **200-PW-6 OU and three of the six 200-PW-1 OU waste sites, also known as the Low-Salt Waste Group.** The contaminated soils and debris will be excavated a depth of 6.7 to 10.1 m (22 to 33 ft) bgs, with disposal at ERDF or WIPP, as appropriate. The excavation area will be sampled in accordance with the SAP (DOE/RL-2015-22) and backfilled. After the excavations are filled, an evapotranspiration barrier will be constructed over the remaining waste in these waste sites.

- **Two settling tanks.** Due to the difficulty anticipated for removing the sludge and the lack of structural integrity of the tanks, the contaminated sludge will be removed to the extent required to facilitate removal of the settling tanks and the tanks will be size reduced and removed, with disposal of the sludge and tank debris at WIPP or ERDF, as appropriate. The excavation area will be sampled in accordance with the SAP (DOE/RL-2015-22), backfilled, and revegetated. Closure using the substantive portions of WAC 173-303-610(2) is the remedial approach currently prescribed in the ROD (EPA et al, 2011). If removal of the tanks is implemented, this alternative will be evaluated as a potential change to the ROD (EPA et al., 2011).

---

[5] DOE/RL-2015-22, 2015, *Sampling and Analysis Plan for the 200-CW-5, 200-PW-1, and 200-PW-6 Operable Units*, Decisional Draft, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

- An SVE system was implemented as an expedited response action to remove and treat carbon tetrachloride contamination in the vadose zone at waste sites in the High-Salt Waste Group. The system has operated since 1992 and has effectively removed and treated carbon tetrachloride to levels that are protective of groundwater. SVE is incorporated into the selected remedy. Achievement of the cleanup levels stipulated by the remedy has been evaluated in accordance with PNNL-21843, *Soil Vapor Extraction System Optimization, Transition, and Closure Guidance*[6]. The evaluation concludes that the guidelines for closure of the SVE system have been met and recommends termination of SVE operations and closure of the SVE system (DOE/RL-2014-48[7]). The process for formal approval of termination and closure of the SVE system by EPA is under way.

ICs and long-term monitoring are required for waste sites in the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs where contamination is left in place that precludes an unrestricted land use. These ICs and land use controls will ensure that activities are consistent with and restricted to the reasonably anticipated future industrial land uses for the Inner Area of the Central Plateau.

This RD/RAWP describes a viable technical approach that was developed to achieve the RAs and protect worker safety and the environment. A critical path schedule and a detailed cost estimate were developed. Including the typical acquisition process for a capital project of this magnitude, this work will likely take approximately 20 years from the initial funding request to turnover for long-term stewardship, for a cost of approximately $1.05 billion. The $1.05 billion estimate includes $40 million for long-term stewardship.

---

[6] PNNL-21843, 2013, *Soil Vapor Extraction System Optimization, Transition, and Closure Guidance*, Pacific Northwest National Laboratory, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0088374.

[7] DOE/RL-2014-48, 2014, *Endpoint Evaluation for the 200-PW-1 Operable Unit Soil Vapor Extraction System Operations*, Draft A, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Contents

Appendices

Figures

Tables

Terms

ALARA	as low as reasonably achievable
AMP	air monitoring plan
ARAR	applicable or relevant and appropriate requirement
ASME	American Society of Mechanical Engineers
BARCT	best available radionuclide control technology
bgs	below ground surface
CCU	Cold Creek unit
CD	critical decision
CDR	conceptual design report
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CHPRC	CH2M HILL Plateau Remediation Company
COC	contaminant of concern
CQAP	construction quality assurance plan
CRD	Contractor Requirements Document
CSDR	conceptual safety design report
CWC	Central Waste Complex
DOE	U.S. Department of Energy
DOE-HQ	DOE Headquarters
DOE-RL	DOE Richland Operations Office
DQO	data quality objective
DSA	documented safety analysis
DWMU	dangerous waste management unit
ECO	environmental compliance officer
Ecology	Washington State Department of Ecology
EM	Environmental Management
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
ET	evapotranspiration

FDC	functional design criteria
FRD	functions and requirements document
FY	fiscal year
GPR	ground-penetrating radar
HASP	health and safety plan
HCP EIS	Hanford Comprehensive Land-Use Plan Environmental Impact Statement
HEPA	high-efficiency particulate air
HHE	human health and the environment
HQ	hazard quotient
IC	institutional control
IPT	integrated project team
ISMS	Integrated Safety Management System
LIGO	Laser Interferometer Gravitational Wave Observatory
LLW	low-level waste
MEI	maximally exposed individual
NA	not applicable
NCP	National Contingency Plan (40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan")
NPL	National Priorities List (40 CFR 300, Appendix B)
O&M	operations and maintenance
OS&H	Occupational Safety and Health
OU	operable unit
PCB	polychlorinated biphenyl
PDSA	preliminary documented safety analysis
PEP	project execution plan
PFP	Plutonium Finishing Plant
PM	particulate matter
PPE	personal protective equipment
ppmv	parts per million by volume
PRB	project review board

PTE	potential-to-emit
QA	quality assurance
RA	remedial action
RAO	remedial action objective
RCRA	*Resource Conservation and Recovery Act of 1976*
RD/RAWP	remedial design/remedial action work plan
RDR	remedial design report
ROD	record of decision
RTD	removal, treatment (as needed), and disposal
RWP	radiological work permit
SAP	sampling and analysis plan
SDS	safety design strategy
SLB2	standard large box 2
SRS	soil and debris remediation system
STRS	settling tanks remediation system
SVE	soil vapor extraction
SWB	standard waste box
TAP	toxic air pollutant
TEDE	total effective dose equivalent
TIPR	technically independent project review
TPA	Tri-Party Agreement (*Hanford Federal Facility Agreement and Consent Order*)
TRU	transuranic
TSD	treatment, storage, and disposal
UCL	upper confidence limit
UMM	unit managers meeting
VE	value engineering
WBS	work breakdown structure
WIPP	Waste Isolation Pilot Plant

This page intentionally left blank.

1 Introduction

Chapter 1 provides a description of the site and context for the regulatory decisions and remedial action (RA) of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Source Operable Units (OUs).

1.1 Background

The U.S. Department of Energy's (DOE's) Hanford Site is a 1,517 km^2 (586 mi^2) federal facility located in southeastern Washington State along the Columbia River. For administrative purposes, the Hanford Site was divided into four National Priorities List (40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," hereinafter called the National Contingency Plan [NCP], Appendix B, "National Priorities List," hereinafter called the NPL) sites under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) in 1989, one of which is the 200 Areas. In anticipation of the NPL (40 CFR 300, Appendix B) listing, DOE, the U.S. Environmental Protection Agency (EPA), and the Washington State Department of Ecology (Ecology) entered into the Tri-Party Agreement (TPA) (Ecology et al., 1989a, *Hanford Federal Facility Agreement and Consent Order*) in May 1989. This agreement established a procedural framework and schedule for developing, implementing, and monitoring CERCLA response actions and *Resource Conservation and Recovery Act of 1976* (RCRA) compliance and permitting on the Hanford Site.

The 200 Area NPL (40 CFR 300, Appendix B) site, commonly referred to as the Central Plateau, encompasses approximately 190 km^2 (75 mi^2) near the center of the Hanford Site and contains multiple waste sites and contaminated facilities (Figure 1-1). The Central Plateau also overlies several groundwater contamination plumes. To facilitate cleanup, the waste sites, facilities, and groundwater plumes have been grouped by geographic areas, process types, or cleanup components into several OUs.

Final RAs were selected for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Source OUs in accordance with CERCLA, the TPA (Ecology et al., 1989a), and the NCP (40 CFR 300). The RAs are described in EPA et al., 2011, *Record of Decision, Hanford 200 Area, Superfund Site, 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*, hereinafter called the record of decision (ROD). The purpose of the RAs is to address source contamination that poses threats to human health and the environment (HHE).

This remedial design/remedial action work plan (RD/RAWP) supports implementation of RAs established in the ROD (EPA et al., 2011) within the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Source OUs. This RD/RAWP establishes the general size, scope, and character of the RA project and identifies the technical requirements of the RA.

The DOE Richland Operations Office (DOE-RL) is the lead agency responsible to perform the RAs described in this RD/RAWP, and EPA is the lead regulatory agency, as identified in Section 5.6 and Appendix C of the TPA (Ecology et al., 1989a).

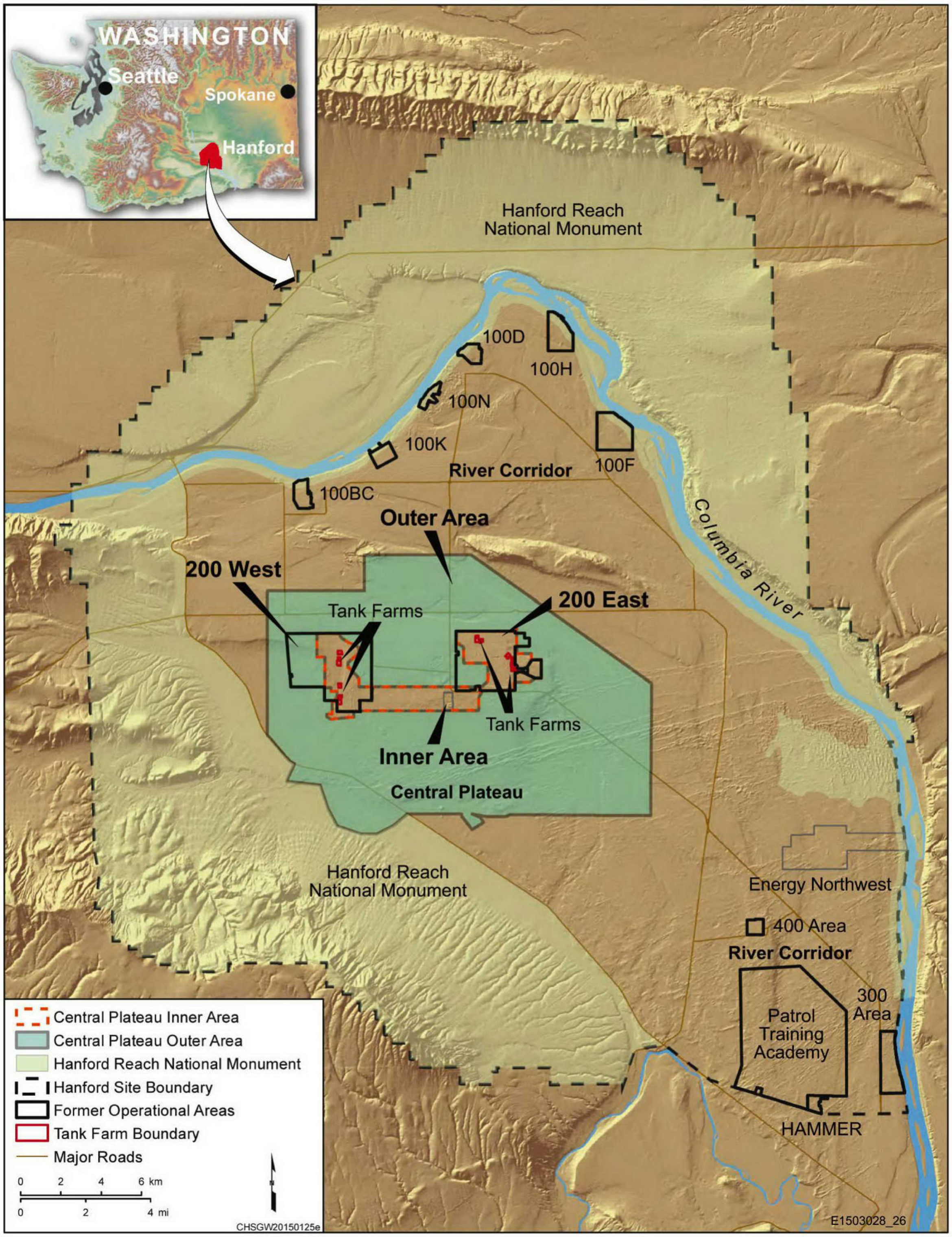

Figure 1-1. Hanford Site and NPL Sites

1.2 Purpose

This RD/RAWP describes how the RAs will be designed, installed, and operated to meet the remedial action objectives (RAOs) identified in the ROD (EPA et al., 2011). The selected remedy for these sites addresses soils and subsurface disposal structures, two settling tanks, and associated pipelines contaminated primarily with radioactive plutonium and cesium. Some of the waste materials are considered principal threat wastes. Principal threat waste is defined as source material that is considered highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. Structures and other debris that must be removed in order to conduct required remediation will also be excavated. The remedy includes a combination of removal, treatment (as needed), and disposal (RTD); construction of evapotranspiration (ET) barriers; maintenance and enhancement of existing soil cover; and institutional controls (ICs).

A soil vapor extraction (SVE) system was implemented as an expedited response action to remove and treat carbon tetrachloride contamination in the vadose zone at the 200-PW-1 OU waste sites. The system has operated since 1992 and has effectively removed and treated carbon tetrachloride. Between 1992 and 2012, over 80,000 kg of carbon tetrachloride was removed from the vadose zone. SVE is incorporated into the selected remedy for the 200-PW-1 OU. Achievement of the cleanup levels stipulated by the remedy has been evaluated in accordance with PNNL-21843, *Soil Vapor Extraction System Optimization, Transition, and Closure Guidance*. The evaluation concludes the guidelines for closure of the SVE system have been met and recommends termination of SVE operations and closure of the SVE system (DOE/RL-2014-48, *Endpoint Evaluation for the 200-PW-1 Operable Unit Soil Vapor Extraction System Operations*). The process for formal approval of termination and closure of the SVE system by EPA is under way.

The overarching requirement in the ROD (EPA et al., 2011) is to meet the soil cleanup levels consistent with an industrial exposure scenario. This RD/RAWP is being submitted to the lead regulatory agency (EPA) in accordance with Section 11.6 of the TPA Action Plan (Ecology et al., 1989b, *Hanford Federal Facility Agreement and Consent Order Action Plan*), which states: "Within 180 days of ROD signature, or an alternative period designated in the ROD, an RD/RAWP including schedule, along with a milestone change package, shall be submitted for lead regulatory agency review and approval." The ROD (EPA et al., 2011) specifies an alternative period for submittal that requires DOE to submit the RD/RAWP to EPA for formal review on or before September 30, 2015 (TPA Milestone M-016-125).

1.3 Scope

The scope of this RD/RAWP includes the plan and schedule for successful implementation of the RAs selected to meet the requirements of the ROD (EPA et al., 2011). The selected remedy for the sites is a combination of RTD, ET barriers, maintenance and enhancement of existing soil cover, and ICs to address the chemical and radionuclide contaminants of concern (COCs). SVE is incorporated into the selected remedy for the 200-PW-1 OU and the vadose zone cleanup levels have been determined to have been achieved.

The remedy does not address groundwater contamination associated with these sites. Groundwater located beneath these OUs in the 200 West Area is being addressed through separate CERCLA processes for the 200-ZP-1 and 200-UP-1 Groundwater OUs.

1.4 Site Description and Background

The two major geographic cleanup areas within the Central Plateau include the 170 km^2 (65 mi^2) Outer Area and the 25 km^2 (10 mi^2) Inner Area (Figure 1-1). The 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs are located in the Central Plateau Inner Area. The Hanford Site environmental cleanup mission began in 1989, following a plutonium production era that lasted from 1943 to 1989. During plutonium production, the Hanford Site was divided into production areas, including the 200 East and 200 West Areas, which contain the major nuclear fuel processing, waste management, and disposal facilities. This RD/RAWP presents information related to the primary sources of contamination from plutonium production in the 200 East and 200 West Areas. The historical designations for the 200 East and 200 West Areas are used in context throughout this work plan, where appropriate.

The 200 East and 200 West Areas are separated from each other by several miles. The main function of the facilities in the 200 East and 200 West Areas was to remove plutonium from the uranium fuel rods after they had been subjected to a nuclear chain reaction in the 100 Area reactors. Five massive processing facilities, called "canyons", encompassed the site of these separation and removal activities. Each canyon measures approximately three football fields long, with walls extending 18.3 m (60 ft) above the ground and dropping another 12.2 m (40 ft) below it.

Large volumes of liquid waste were generated from the separation of plutonium at the various processing plants in the 200 West and 200 East Areas. Billions of gallons of process wastewater were both intentionally and unintentionally put onto the ground in the 200 Area. The processes were intended to recover as much plutonium as possible prior to discharge of the waste liquids, but the waste streams still contained low levels of plutonium and other contaminants.

The waste sites in the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs are associated with subsurface liquid waste handling and disposal at sites that were engineered and constructed to receive liquid waste and discharge it into the soil beneath the sites. Detailed information describing the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OU waste sites can be found in the following reports:

- DOE/RL-2003-11, *Remedial Investigation Report for the 200-CW-5 U Pond/Z Ditches Cooling Water Group, the 200-CW-2 S Pond and Ditches Cooling Water Group, the 200-CW-4 T Pond and Ditches Cooling Water Group, and the 200-SC-1 Steam Condensate Group Operable Units*
- DOE/RL-2004-24, *Feasibility Study for the 200-CW-5 Cooling Water Operable Unit*
- DOE/RL-2006-51, *Remedial Investigation Report for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*
- DOE/RL-2007-27, *Feasibility Study for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*

1.4.1 Land Use

The 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OU waste sites are all located within the approximately 52 km^2 (20 mi^2) Central Plateau area. The reasonably anticipated future land use for the Inner Area of the Central Plateau is industrial (DOE worker) for at least 50 years and then industrial (DOE or non-DOE worker) thereafter. DOE issued the Hanford Comprehensive Land-Use Plan Environmental Impact Statement (HCP EIS [DOE/EIS-0222-F]) and associated HCP EIS ROD (64 FR 61615) in 1999. The HCP EIS presents the potential environmental impacts of alternative land-use plans for Hanford and presents the land-use implication of ongoing and proposed activities. Under the preferred land-use alternative selected in the HCP EIS ROD, the Central Plateau was designated for industrial exclusive use, defined as areas suitable and desirable for treatment, storage, and disposal (TSD) of hazardous, dangerous, radioactive, and nonradioactive wastes, as well as related activities.

The Tri-Party agencies have agreed that the reasonably anticipated future land use for the Inner Area of the Central Plateau is industrial land use and includes TSD of hazardous, dangerous, radioactive, and nonradioactive wastes. As long as residual contamination remains above levels that allow for unrestricted use, institutional controls will be required.

1.4.2 Physical Setting

The 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OU waste sites are located in the Inner Area of the Hanford Site Central Plateau (Figure 1-2). The 200 Areas are located on a broad, relatively flat area that constitutes a local topographic high region commonly referred to as the 200 Area Plateau. The plateau is a giant flood bar (Cold Creek Bar) that was formed during cataclysmic Ice Age floods from glacial Lake Missoula. The flood bar may have started forming during the earliest floods 1 to 2 million years ago. The Cold Creek Bar trends generally east-west, with elevations between 197 and 225 m (647 to 740 ft). The plateau drops off rather steeply to the north and east into a former flood channel that runs east-southeast, with elevation changes of between 15 and 30 m (50 and 100 ft). The plateau gently decreases in elevation to the south into the Cold Creek valley. Most of the 200 West Area and the southern half of the 200 East Area are situated on the Cold Creek Bar, while the northern half of the 200 East Area lies on the edge of a former flood channel.

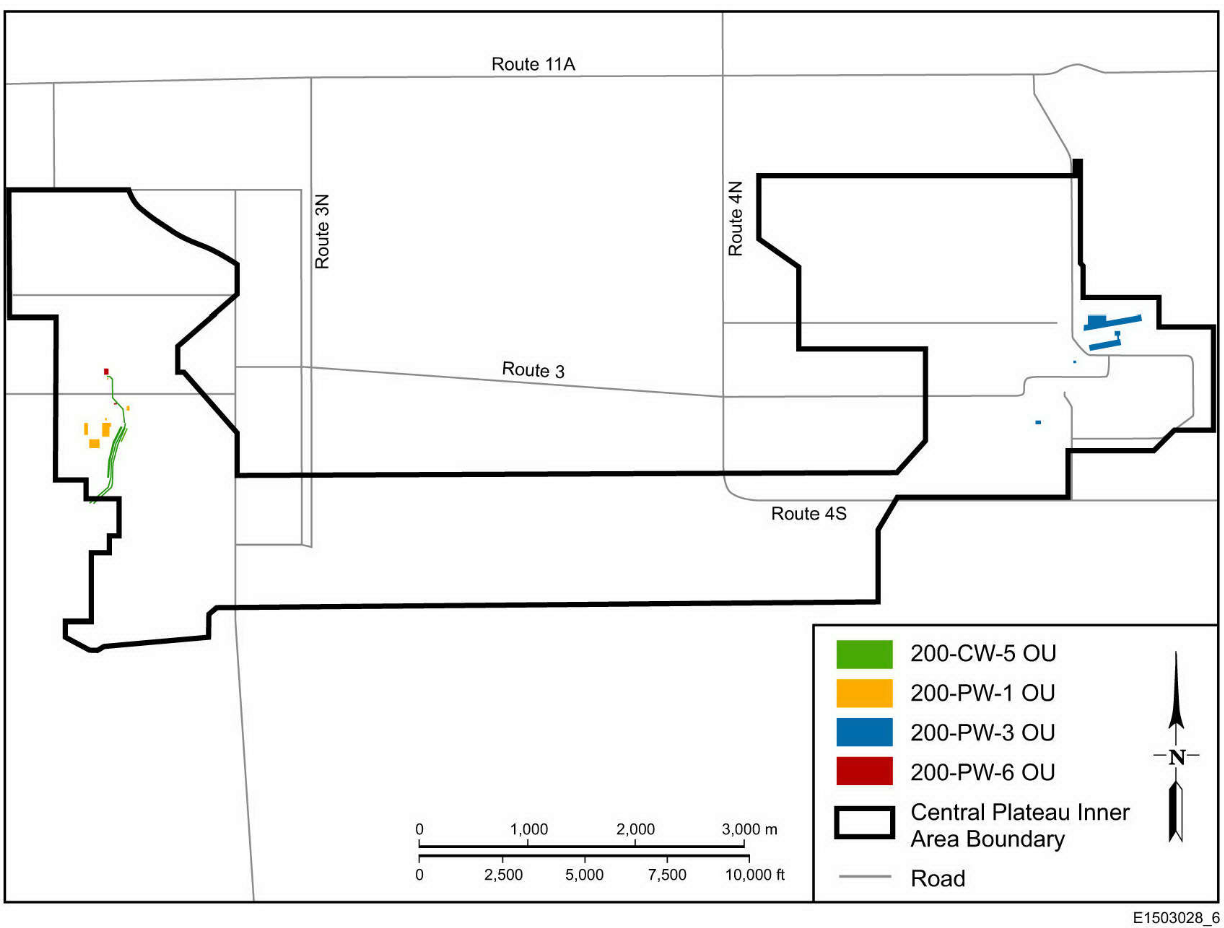

Figure 1-2. Location of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs

Waste sites in the 200 West Area are situated on a relatively flat area within the secondary flood channel that bisects the 200 West Area. Surface elevations range from approximately 201 to 217 m (660 to 712 ft). Waste site surface elevations in the 200 East Area range from about 189 m (620 ft) in the northern portion to about 220 m (720 ft) in the southern portion. The ground surface in the 200 East Area slopes gently to the northeast.

Basalt of the Columbia River Basalt Group and a sequence of overlying sediments comprise the local geology. The overlying sediments are approximately 169 m (555 ft) thick and primarily consist of the Ringold Formation and Hanford formation, which are composed of sand and gravel with some silt layers. Surface elevations range from approximately 200 to 217 m (660 to 712 ft). The sediment thickness in the 200 West Area above the water table (the vadose zone) ranges from 40 to 75 m (132 to 246 ft). Sediments in the vadose zone are the Ringold Formation (the uppermost Ringold Formation unit E and the Upper Ringold unit 4), Cold Creek unit (CCU), and Hanford formation.

The vadose zone is the unsaturated interval between the ground surface and the water table. The vadose zone is approximately 104 m (340 ft) thick in the southern section of the 200 East Area. Sediments in the vadose zone are dominated by the Hanford formation, although the CCU and part of the Ringold Formation are above the water table in the 200 West Area. In the 200 West Area, the vadose zone thickness ranges from 40 to 75 m (132 to 246 ft). Historically, and as recently as the early 1900s, perched water has been documented above the CCU at locations in the 200 West Area. While liquid waste facilities were operating, localized areas of saturation or near saturation were created in the soil column. With the reduction of artificial recharge from waste facilities in the 200 Area in 1995, downward flux of liquid in the vadose zone beneath these waste sites has been decreasing.

The top of the unconfined aquifer in the 200 Area occurs within the Ringold Formation, the CCU, or the Hanford formation, depending on location. The base of the unconfined aquifer is the top of the Ringold Formation unit 8 (lower mud), or the top of the basalt where unit 8 is absent at the 200 West Area, and the top of the basalt in the 200 East Area. Groundwater in the unconfined aquifer flows from recharge areas where the water table is higher (west of the Hanford Site) to areas where it is lower, near the Columbia River.

Depth to groundwater in the 200 East Area and vicinity ranges from about 54 m (177 ft) near the former B Pond area to about 104 m (340 ft) near the southern boundary of the 200 East Area. The configuration of contaminated groundwater plumes indicates that groundwater flows to the northwest in the northern half of the 200 East Area and to the east/southeast in the southern half of the 200 East Area. Groundwater beneath the 200 West Area is found primarily in the Ringold Formation. Depth to water varies from about 0.2 m (132 ft) to greater than 75 m (246 ft). In the 200 West Area, groundwater in the unconfined aquifer typically flows from west to east.

Liquid wastes discharged from operations are considered the most significant type of discharge to the environment in terms of volume and number of constituents. According to estimates, 1.7 trillion L (450 billion gal) of liquid waste, some containing radionuclides and hazardous chemicals, have been released to the ground at the Hanford Site since 1944. Much of this contamination remains in the vadose zone above the water table, but some of the more mobile contaminants have reached groundwater. Most sources of artificial recharge were terminated in 1995.

1.4.3 Nature and Extent of Contamination

The selected remedy for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs addresses soils and subsurface disposal structures, two settling tanks, and associated pipelines contaminated primarily with radioactive plutonium and cesium. Some of the waste materials are considered principal threat wastes.

Principal threat waste is defined as source materials that are considered highly toxic or highly mobile and that generally cannot be reliably contained or would present a significant risk to HHE should exposure occur. The remedy includes a combination of RTD, construction of ET barriers, maintenance and enhancement of existing soil cover, operation of the SVE system, and ICs. Table 1-1 provides a summary of the waste sites included in the ROD (EPA et al., 2011).

The locations of each of these waste sites in the 200 East and 200 West Areas are shown in Figures 1-3 and 1-4, respectively. A summary of the nature and extent of contamination for waste sites in the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs is contained in Appendix A.

Table 1-1. 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OU Waste Sites

Waste Site	Years of Operation	Estimated Inventory of Plutonium Isotopes (kg)	Estimated RTD Volume (m^3)
200-CW-5 Operable Unit			
216-Z-1D Ditch	1944–1959	2.4	66,320
216-Z-11 Ditch	1959–1971	2.4	35,210
216-Z-19 Ditch	1971–1981	0.14	40,770
216-Z-20 Tile Field	1981–1995	0.033	47,110
UPR-200-W-110 Unplanned Release	1971	Unknown	13,040
200-W-207-PL Pipeline*	1949–1995	Unknown	2,300
200-PW-1 Operable Unit			
216-Z-1A Tile Field	1964–1969	57	41,860
216-Z-9 Trench	1955–1962	48	12,300
216-Z-18 Crib	1969–1973	23	49,500
200-W-174-PL Pipeline*	1964–1973	Unknown	12,000
200-W-206-PL Pipeline*	1955–1962	Unknown	1,000
216-Z-1&2 Crib	1949–1952	7	10,330
216-Z-3 Crib	1952–1959	5.7	21,330
216-Z-12 Crib	1959–1973	25.1	27,300
241-Z-361 Settling Tank	1949–1973	29	13,600
200-PW-3 Operable Unit			
216-A-7 Crib	1956–1957 and 1966	NA	Enhance soil cover.
216-A-8 Crib	1955–1958 1966–1985 (Intermittent)	NA	Enhance soil cover.

Table 1-1. 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OU Waste Sites

Waste Site	Years of Operation	Estimated Inventory of Plutonium Isotopes (kg)	Estimated RTD Volume (m^3)
216-A-24 Crib	1958–1966	NA	Enhancement of the soil cover is not needed.
216-A-31 Crib	1964–1966	NA	Enhancement of the soil cover is not needed.
UPR-200-E-56 Unplanned Release	1979	NA	Enhance soil cover.
200-PW-6 Operable Unit			
216-Z-5 Crib	1945–1947	0.34	8,320
200-W-208-PL Pipeline	1959–1973	Unknown	10,000
200-W-210-PL Pipeline	1949–1959	Unknown	4,300
241-Z-8 Settling Tank	1955–1962	1.5	2,480
200-W-205-PL Pipeline*	1955–1962	Unknown	Included with the 241-Z-8 waste site.
200-W-220-PL Pipeline*	1949–1973	Unknown	Included with the 241-Z-361 waste site.
216-Z-8 French Drain	1955–1962	<0.05	The remedy does not include RTD.
216-Z-10 Injection/Reverse Well	February to June 1945	<0.05	The remedy does not include RTD.

* Remedial action implementation will remediate only segments of these pipeline waste sites that are within the project boundary and excavation footprint. The remaining segments of the pipeline waste sites will be transferred into another OU and addressed in future remedial actions.

IC = institutional control

NA = not applicable

OU = operable unit

RTD = removal, treatment (as needed), and disposal

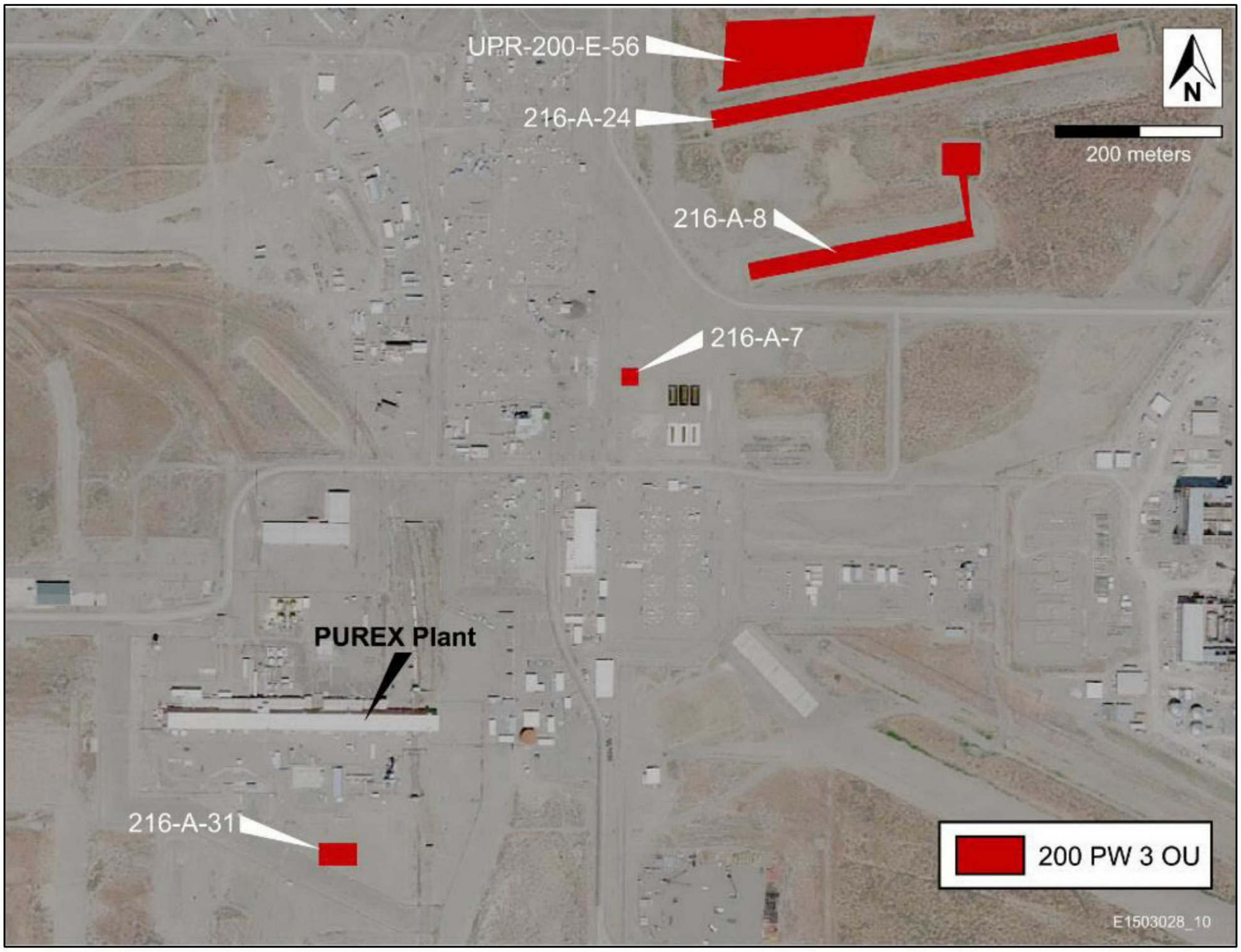

Figure 1-3. Location of Waste Sites in the 200 East Area

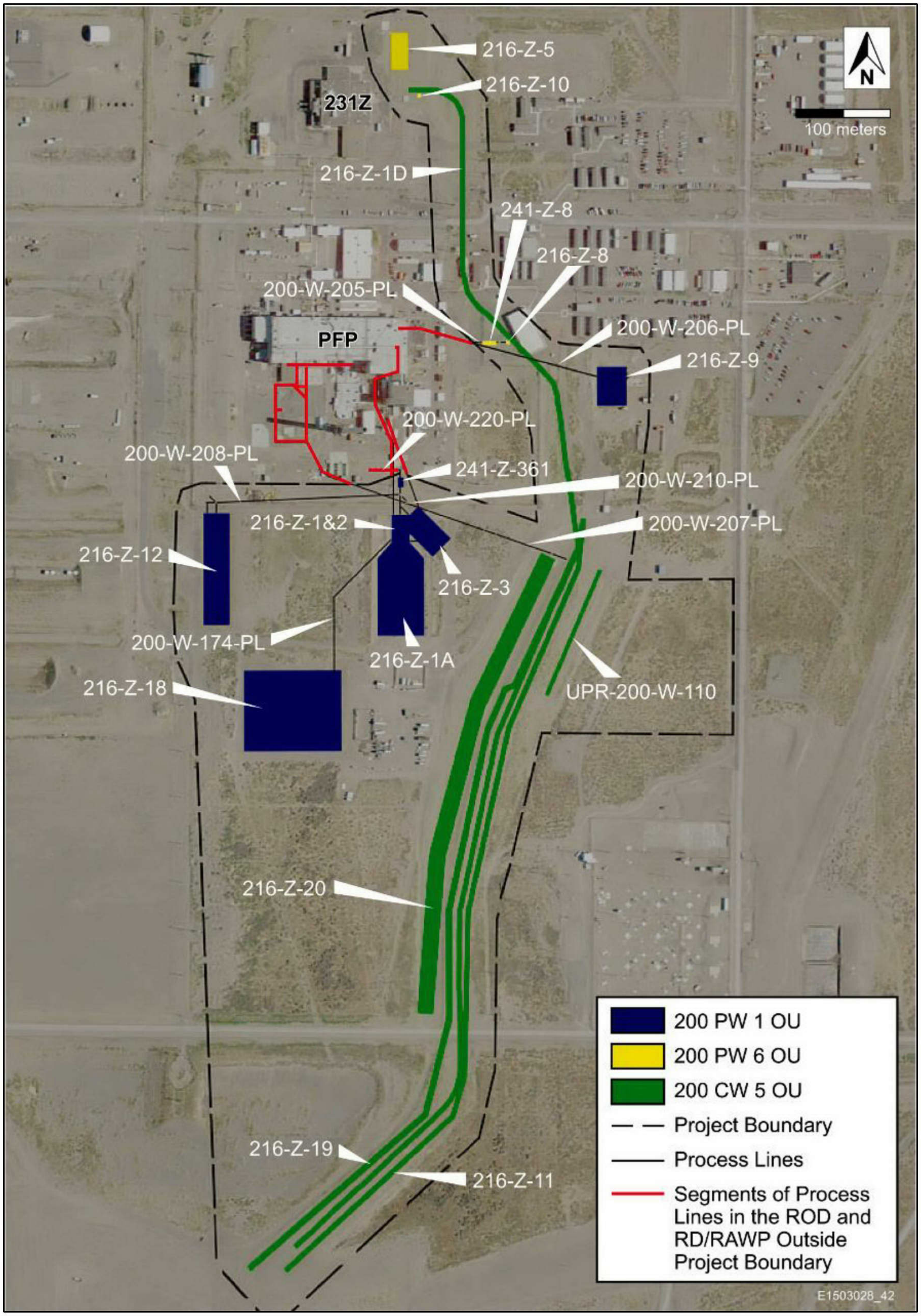

Figure 1-4. Location of Waste Sites in the 200 West Area

2 Basis for Remedial Action

Chapter 2 describes the regulatory decision, provides an overview of the ROD (EPA et al., 2011), and provides the applicable or relevant and appropriate requirements (ARARs) for the RA.

2.1 Basis for Action

Human health risk assessments for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OU waste sites were developed for quantitative evaluation of both cancer risks and noncancer health hazards from exposure to radionuclides and nonradioactive contaminants present at the waste sites. The baseline risk assessment evaluated risks under current industrial land use conditions, assuming no RA was taken, and under unrestricted land use conditions. It provided the basis for taking action and identified the contaminants and exposure pathways that need to be addressed by the RA.

Based on the information and results of the risk assessment, COCs for soils in the 200-PW-1 and 200-PW-6 OUs are americium-241 and plutonium-239/plutonium-240. Carbon tetrachloride and methylene chloride were also identified as COCs for protection of groundwater for the 200-PW-1 OU. COCs for soils in the 200-CW-5 OU are americium-241, plutonium-239/plutonium-240, cesium-137, radium-226, strontium-90, polychlorinated biphenyls (PCBs), boron, and mercury. The COC for soils in the 200-PW-3 OU is cesium-137. Two other contaminants (technetium-99 and nitrate) were identified as contaminants of interest. DOE and EPA have determined that these contaminants do not pose an unacceptable risk, based on fate and transport modeling results and process knowledge of the type of liquid waste discharged at these waste sites. However, additional sampling will be conducted to confirm contaminant levels as part of the remedial design. Therefore, nitrate is added as a contaminant of interest at the 200-CW-5 waste sites. Technetium-99 and nitrate are added as contaminants of interest at specific waste sites (216-Z-1A, 216-Z-9, and 216-Z-18) in the 200-PW-1 OU.

The response action selected in the ROD (EPA et al., 2011) is necessary to protect the welfare of public health and the environment from actual or threatened releases of hazardous substances, pollutants, or contaminants into the environment. Such a release, or threat of release, may present an imminent and substantial endangerment to public health, welfare, or the environment.

2.2 Selected Remedy

The ROD (EPA et al., 2011) presents the selected final RA for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs, which are part of the overall soil remediation effort in the Inner Area. The Inner Area is approximately 10 mi^2 (26 km^2) in the middle of the Central Plateau encompassing the region where chemical processing and waste management activities occurred. The 200-CW-5, 200-PW-1, and 200-PW-6 OUs are located in the 200 West Area, and the 200-PW-3 OU is located in the 200 East Area. Cleanup levels for the Inner Area are expected to be based on industrial land use.

Groundwater located beneath these OUs in the 200 West Area is being addressed through separate CERCLA processes for the 200-ZP-1 and 200-UP-1 Groundwater OUs. The remaining Inner Area waste sites and 200 East Area groundwater OUs will be addressed under separate CERCLA processes for the appropriate OUs.

The selected remedy for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs addresses soils and subsurface disposal structures, two settling tanks, and associated pipelines contaminated primarily with plutonium and cesium. Structures and other debris that must be removed in order to conduct required remediation will be excavated as well. Components of the selected remedy are summarized in the following subsections.

2.2.1 Removal, Treatment, and Disposal of Contaminated Soil and Debris

RTD of soil and debris to the specified depths or specified cleanup levels will be used to address plutonium contaminated soils and subsurface structures and debris. This consists of the following actions:

- Removing a portion of contaminated soil, structures, and debris
- Treating these removed wastes, as required, to meet waste disposal requirements at the Environmental Restoration and Disposal Facility (ERDF), which is located on the Hanford Site, or waste acceptance criteria for offsite disposal at the Waste Isolation Pilot Plant (WIPP), which is a 0.8 km (0.5 mi) deep repository in New Mexico that has limited capacity
- Disposal at ERDF or WIPP

Selected pipelines associated with these OUs will also be excavated and disposed of at ERDF or WIPP. Cleanup levels have been selected that are protective of groundwater and the current and reasonably expected future industrial land use. Application of the remedy to the specific waste sites addressed in the ROD (EPA et al., 2011) is summarized in the following subsections.

2.2.1.1 Z Ditches Waste Group Remedy Components

RTD of contaminated soils at ERDF or WIPP, as appropriate, will be applied to the Z Ditches Waste Group, which consists of the 216-Z-1D Ditch, 216-Z-11 Ditch, 216-Z-19 Ditch, 216-Z-20 Tile Field, and UPR-200-W-110 Unplanned Release waste sites. For the Z Ditches Waste Group, excavation will remove contaminated soil, located from 0 to 4.6 m (0 to 15 ft) below ground surface (bgs), that exceeds cleanup levels for plutonium-239/plutonium-240, americium-241, cesium-137, radium-226, strontium-90, PCBs, boron, and mercury. The RTD process for this waste group includes the following actions:

- Removal and stockpiling of clean overburden for backfilling
- Removal of contaminated soils and debris that exceed the cleanup levels identified for previously specified contaminants to a depth of 4.6 m (15 ft) bgs
- Removal of structures and other debris within the excavation areas, which includes the pipeline (200-W-207-PL) associated with this waste group
- Sampling during design to confirm the extent of excavation required
- Placement of contaminated soil and debris in waste containers
- Screening of waste in containers to determine if it qualifies for disposal at ERDF (if transuranic [TRU] waste is present in the containers, it will be packaged to meet waste disposal criteria for disposal at WIPP)
- Treatment, if needed, of waste to meet disposal requirements
- Sampling of plutonium-239/plutonium-240, americium-241, cesium-137, radium-226, strontium-90, PCBs, boron, and mercury to confirm that contaminant levels meet cleanup levels (sampling will be done in accordance with the sampling and analysis plan [SAP], DOE/RL-2015-22, *Sampling and Analysis Plan for the 200-CW-5, 200-PW-1, and 200-PW-6 Operable Units*)
- Sampling of nitrate, in accordance with the SAP (DOE/RL-2015-22), to confirm that contaminant levels do not pose an unacceptable risk to groundwater (if sampling indicates that contaminant levels pose an unacceptable risk to groundwater, the CERCLA process will be used to modify the remedy, as necessary, to protect groundwater)

2.2.1.2 High-Salt Waste Group Remedy Components

RTD of contaminated soils at ERDF or WIPP, as appropriate, will be applied to the High-Salt Waste Group, which consists of the 216-Z-1A Tile Field, 216-Z-9 Trench, and 216-Z-18 Crib waste sites. The RTD process for this waste group includes the following actions:

- Removal and stockpiling of clean overburden for backfilling
- Removal of soils and debris to 6.1 m (20 ft) bgs at the 216-Z-1A Tile Field, 7 m (23 ft) bgs at the 216-Z-9 Trench, and 6.1 m (20 ft) bgs at the 216-Z-18 Crib (includes the pipelines [200-W-174-PL and 200-W-206-PL] and removal of above-grade structures at the 216-Z-9 Trench)
- Removal of structures and other debris within the excavation areas or that must be removed in order to conduct required remediation, which may include removal of parts of 200-W-178-PL from the 241-Z Building to the third bend in 200-W-178-PL (200-W-178-PL is part of a dangerous waste management unit [DWMU], and any necessary removal of 200-W-178-PL parts will satisfy ARARs for DWMUs)
- Placement of contaminated soil and debris in waste containers
- Screening of waste in containers to determine if it qualifies as TRU waste (waste qualified as TRU will be packaged to meet waste disposal criteria for WIPP; other waste will be packaged to meet waste disposal criteria for ERDF)
- Treatment, if needed, of waste to meet disposal requirements
- Sampling of nitrate and technetium-99 in accordance with the SAP (DOE/RL-2015-22), to confirm that contaminant levels do not pose an unacceptable risk to groundwater (if sampling indicates that contaminant levels pose an unacceptable risk to groundwater, the CERCLA process will be used to modify the remedy, as necessary, to protect groundwater)
- After excavating to the specified depths in these waste sites, plutonium-239/plutonium-240 and americium-241 levels will be assessed in accordance with the SAP (DOE/RL-2015-22). DOE will evaluate removing additional plutonium contaminated soil from these waste sites.
- Backfilling of excavations with clean fill, followed by compaction
- Construction of ET barriers over each waste site (ET barrier construction will include planting the barrier surface with vegetation)

2.2.1.3 Low-Salt Waste Group Remedy Components

RTD of contaminated soils at ERDF or WIPP, as appropriate, will be applied to the Low-Salt Waste Group, which consists of the 216-Z-1&2, 216-Z-3, 216-Z-12, and 216-Z-5 Cribs. The RTD process for this waste group includes the following actions:

- Removal and stockpiling of clean overburden for backfilling
- Removal of soils and debris to 7.6 m (25 ft) bgs at the 216-Z-1&2 Cribs, 10.1 m (33 ft) bgs at the 216-Z-3 Crib, 6.7 m (22 ft) bgs at the 216-Z-5 Crib, and 7.3 m (24 ft) bgs at the 216-Z-12 Crib
- Removal of structures and other debris within excavation areas or that must be removed in order to conduct required remediation, which includes 200-W-208-PL and 200-W-210-PL
- Placement of contaminated soil and debris in waste containers

- Screening of waste in containers to determine if it qualifies for offsite disposal at WIPP (waste that does not meet waste acceptance criteria for WIPP will be sent to ERDF)
- Treatment, if needed, of waste to meet disposal requirements
- After excavating to the specified depths in these waste sites, plutonium-239/plutonium-240 and americium-241 levels will be assessed in accordance with the SAP (DOE/RL-2015-22)
- Backfilling of the excavations with clean fill, followed by compaction
- Construction of ET barriers over each waste site (requirements for these ET barriers are the same as those for the High-Salt Waste Group)

2.2.1.4 Settling Tank Waste Group Remedy Components

The ROD (EPA et al., 2011) identifies the selected RA applied to the Settling Tank Waste Group, which consists of the 241-Z-361 and 241-Z-8 Settling Tanks, as removal of the sludge followed by tank stabilization. Remediation and stabilization are to be completed in a manner that would satisfy the substantive requirements for closure of dangerous waste tanks. However, a video examination of the 241-Z-361 settling tank conducted in 1999 revealed the steel liner was severely corroded and portions of the concrete tank were deteriorated, exposing coarse aggregate.

Based on this information, the project team has concerns about the structural integrity of the settling tanks. Disturbing the tanks could present a substantial threat of release to the environment during RAs. Therefore, this RD/RAWP describes an alternative RA to remove the tanks and dispose of the sludge and tank structures at ERDF or WIPP. Tank removal and disposal has been evaluated and is considered a cost-effective alternative that will eliminate the contaminant source.

Tank removal and disposal would include the following actions:

- Removal, as needed, of sludge from tanks
- Packaging of sludge to meet waste disposal criteria for WIPP
- Screening of waste in containers to confirm that it meets the requirements for disposal at WIPP (waste in containers that does not meet WIPP disposal criteria will be treated, if necessary, and sent to ERDF)
- Stabilization of waste material remaining in tanks
- Removal and/or size reducing tank structure to package for disposal at ERDF or WIPP
- Treatment, if needed, of waste to meet disposal requirements
- After removal of the settling tanks, plutonium-239/plutonium-240 and americium-241 levels in the underlying soil will be assessed in accordance with the SAP (DOE/RL-2015-22)
- Backfilling of the excavations with clean fill, followed by compaction and revegetation

If removal of the settling tanks is to be implemented, this alternative will be evaluated as a potential change to the ROD (EPA et al., 2011).

2.2.2 Soil Vapor Extraction

An SVE system was implemented as an expedited response action to remove and treat carbon tetrachloride contamination in the vadose zone at the 200-PW-1 OU waste sites in the High-Salt

Waste Group. The system has been in operation since 1992 and has effectively removed and treated carbon tetrachloride in the vadose zone. SVE is incorporated into the selected remedy. Achievement of the cleanup levels stipulated by the remedy has been evaluated and the conclusion was that the guidelines for closure of the SVE system have been met. The evaluation recommends termination of SVE operations and closure of the SVE system (DOE/RL-2014-48). The process for formal approval of termination and closure of the SVE system by EPA is under way.

2.2.3 Maintain and Enhance Existing Soil Covers

For the 200-PW-3 OU waste sites, also known as the Cesium-137 Waste Group, soil covers will be used to provide a minimum of 4.6 m (15 ft) of uncontaminated soil over each waste site. Soil cover for this waste group requires the addition of soil, as necessary, to the 216-A-7 and 216-A-8 Cribs and UPR-200-E-56 Unplanned Release waste sites to achieve a minimum 4.6 m (15 ft) of cover and maintenance of a 4.6 m (15 ft) thickness of soil cover.

Contamination at the other two waste sites (216-A-24 and 216-A-31 Cribs) is deeper than 4.6 m (15 ft) from the ground surface and will not require additional backfill.

2.2.4 Other Sites Remedy Components

Two 200-PW-6 OU waste sites (216-Z-8 French Drain and 216-Z-10 Injection/Reverse Well) were determined to have limited contamination and do not pose a risk to HHE. Therefore, no action has been selected for these waste sites.

2.2.5 Institutional Control Component

ICs and long-term monitoring will be required for waste sites in the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs where contamination is left in place that precludes an unrestricted land use. These ICs and land use controls will be required to ensure that activities are consistent with and restricted to the reasonably anticipated future industrial land uses for the Inner Area of the Central Plateau. DOE is responsible for implementing, maintaining, reporting on, and enforcing the ICs and land use controls. Although DOE may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or other means, DOE shall retain ultimate responsibility for remedy integrity and ICs.

The following IC performance objectives are required to be met as part of this RA (land use controls will be maintained at the waste sites until EPA authorizes removal of restrictions where contamination is at levels to allow for unrestricted use and unlimited exposure):

- DOE shall control access to the waste sites to prevent unacceptable exposure of humans to contaminants in the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs. Visitors entering any of these OUs will be required to be badged and escorted.
- DOE shall post and maintain warning signs at the waste sites in these OUs that caution visitors and workers of potential hazards from contaminants below the ground surface.
- In the event of any unauthorized access to the site, DOE shall report such incidents to the Benton County Sheriff's Office for investigation and evaluation of possible prosecution.
- DOE shall prohibit activities that are not industrial in nature along with drilling, excavation, or use of soils at these waste sites.
- DOE shall prohibit use of groundwater, located beneath the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs, for the foreseeable future until drinking water standards are achieved.

- DOE shall maintain the integrity of and prohibit activities that could damage or lessen the performance of required ET caps and soil covers.
- DOE shall report annually on the effectiveness of ICs for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs as specified in DOE/RL-2001-41, *Sitewide Institutional Controls Plan for Hanford CERCLA Response Actions and RCRA Corrective Actions*, or an alternative reporting frequency specified by EPA.
- DOE shall provide notice to EPA at least 6 months prior to any transfer or sale of the land in the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs, so EPA can be involved in discussions to ensure that appropriate provisions are included in the transfer terms or conveyance documents to maintain effective ICs. If it is not possible for DOE to notify EPA at least 6 months prior to any transfer or sale, then DOE will notify EPA as soon as possible but no later than 60 days prior to the transfer or sale of any property subject to ICs. In addition to the land transfer notice and preceding discussion provisions, DOE further agrees to provide EPA with similar notice, within the same time frames, as to federal-to-federal transfer of property. DOE shall provide a copy of executed deed or transfer assembly to EPA.
- DOE shall prevent the development and use of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs for residential housing, elementary and secondary schools, childcare facilities, and playgrounds.
- Land use controls will be maintained as long as the contamination remains at levels that do not allow for unrestricted use and unlimited exposure and shall not be removed without the prior authorization of EPA.

2.2.6 Statutory Determinations

The selected remedy for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs is protective of HHE, complies with federal and state ARARs appropriate to the RA, and is cost effective. The selected remedy also utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. The remedy for these OUs does not satisfy the statutory preference for treatment as a principal element of the remedy because there is no feasible technology to practicably treat radionuclide contamination that will not result in larger volumes, creating greater impracticability for disposal. The amount of waste disposed is a limiting factor since plutonium waste generated at the 200-PW-1 and 200-PW-6 OU waste sites will include TRU waste, which will be disposed of at WIPP. The contaminated soils will be packaged appropriately for onsite disposal at ERDF or offsite disposal at WIPP, as appropriate.

The selected remedy was chosen in accordance with CERCLA, as amended by the *Superfund Amendments and Reauthorization Act of 1986*, TPA (Ecology et al., 1989a), and to the extent practicable, NCP (40 CFR 300). This decision is based on the Administrative Record file for these OUs. The State of Washington, through Ecology, concurs with the selected remedy.

2.3 Remedial Action Objectives

RAOs are site-specific objectives that define the extent of cleanup necessary to achieve the specific level of remediation at the site. Three RAOs are identified in the ROD (EPA et. al., 2011):

- **RAO 1:** Prevent unacceptable risk to human health and ecological receptors associated with radiological exposure to waste, soil, or debris contaminated above risk-based criteria by removing the source or eliminating the pathway.

- **RAO 2:** Prevent unacceptable risk to human and ecological receptors associated with nonradiological exposure to waste, soil, or debris contaminated above risk-based criteria by removing the source or eliminating the pathway.
- **RAO 3:** Control sources of potential groundwater contamination to support the Central Plateau groundwater goal of protecting the beneficial uses of groundwater, including protecting the Columbia River from adverse impacts.

2.4 Remedial Action Goals

The selected remedy is expected to achieve RAOs when RTD of contaminated soils, ET barrier construction, soil cover enhancement, and SVE activities are complete. The final cleanup levels listed in Table 2-1 establish acceptable exposure levels for specific contaminants and exposure pathways that are protective of HHE and groundwater.

Table 2-1. Final Cleanup Levels for 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OU Soils

COC	Final Cleanup Level	Basis for Cleanup Level[a]	Risk at Cleanup Level
Plutonium-239 and Plutonium-240	765 pCi/g[b]	Human health (industrial use)	Cancer risk < 1 × 10^{-4} [b,c]
Americium-241	940 pCi/g	Human health (industrial use)	Cancer risk = 1 × 10^{-4} [c]
Cesium-137	17.7 pCi/g	Human health (industrial use)	Cancer risk = 1 × 10^{-4} [c]
Radium-226	4 pCi/g	Human health (industrial use)	Cancer risk = 1 × 10^{-4} [c]
Strontium-90	20 pCi/g	Ecological receptor protection	HQ = 1
Polychlorinated Biphenyl	0.65 mg/kg	Ecological receptor protection	HQ = 1
Boron	0.5 mg/kg	Ecological receptor protection	HQ = 1
Mercury	0.1 mg/kg	Ecological receptor protection	HQ = 1
Carbon Tetrachloride	100 ppmv[d]	Groundwater protection	Excess Lifetime Cancer Risk = 1 × 10^{-5} [e]
Methylene Chloride	50 ppmv[d]	Groundwater protection	

a. Cleanup levels are based on an industrial land use scenario. When cleanup levels for ecological receptors or groundwater protection were lower than human health protection, the lower value was used as the final cleanup level.

b. The preliminary remediation goal identified in the feasibility studies based on 10^{-4} risk was 2,900 pCi/g for plutonium-239/plutonium-240. However, DOE has agreed to a more conservative value of 765 pCi/g for this RA.

c. Final verification sampling for radiological contaminants at the Z Ditches Waste Group will be evaluated to confirm that the aggregate risk level is less than 1 × 10^{-4}.

d. Soil vapor concentrations will be further refined and assessed to ensure they are protective of groundwater.

e. DOE will clean up COCs (carbon tetrachloride and methylene chloride) for the 200-PW-1 OU, subject to WAC 173-340, "Model Toxics Control Act—Cleanup," so the total excess lifetime cancer risk from them does not exceed 1 × 10^{-5} at the conclusion of the remedy.

COC	=	contaminant of concern
DOE	=	U.S. Department of Energy
HQ	=	hazard quotient
OU	=	operable unit
ppmv	=	parts per million by volume
RA	=	remedial action

2.5 Remedy Performance Monitoring

Performance monitoring will be conducted to evaluate the effectiveness of the RA to attain the cleanup levels identified in the ROD (EPA et al., 2011). Monitoring will be used to assess the different components associated with the RA.

A SAP (DOE/RL-2015-22) has been prepared to meet the monitoring needs for the RA. Data quality objectives (DQOs) were developed as a part of this plan. The SAP (DOE/RL-2015-22) provides a description and schedule of activities, including data management and evaluation methods, to meet the data needs identified in the DQO process.

2.6 Applicable or Relevant and Appropriate Requirement Compliance

ARARs are established in Section 13 (Statutory Determinations) of the ROD (EPA et al., 2011). ARARs are the substantive provisions of any promulgated federal environmental or more stringent state environmental or facility siting standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate for a CERCLA site or action. Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, RA, location, or other circumstance found at a CERCLA site (40 CFR 300.5, "Definitions"). Relevant and appropriate requirements are cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility siting laws. While not legally "applicable" to circumstances at a particular CERCLA site, these requirements address problems or situations sufficiently similar to those encountered at the site that their use is well suited (40 CFR 300.5).

Appendix B provides a summary of the ARARs and how they will be implemented by this RA.

3 Remedial Design Approach

Chapter 3 presents an overview of the remedial design approach for addressing the regulatory decision and requirements described in Chapter 2.

3.1 Design Approach

Work on the remedial design approach was initiated in October 2014. An interdisciplinary team of onsite subject matter experts was formed to prepare the approach. The team included project management, requirements management, strategic integration, facility operations, regulatory compliance, radiological controls, nuclear and criticality safety, solid waste management, cost estimating, and three-dimensional modeling personnel.

The initial tasks included analyzing the requirements contained in the ROD (EPA et al., 2011) and gathering background information on the 21 waste sites and 7 pipelines included in the 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 OUs. This information included physical dimensions, waste characterization data, and past operating history.

Based on the data that were gathered, it was confirmed that there is in excess of 200 kg of plutonium contained in the waste sites in the 200-CW-5, 200-PW-1, and 200-PW-6 OUs. Given this level of contamination, subject matter experts were asked to evaluate the potential impacts to the environment and workers based on air emission, radiological exposure, nuclear safety, and criticality safety parameters. This was intended to provide initial design and operating constraints to determine viability of the technical approach.

For this work scope, three primary considerations were evaluated for occupational radiation protection: dose and dose rate, contamination levels, and airborne radioactivity concentrations. These factors were evaluated both for the workers directly involved in the work as well as collocated employees in nearby areas. Since the specific methods of remediation have yet to be determined, certain assumptions were necessary. The evaluation developed correlations, look-up tables, and graphs that compare a range of soil concentrations to the expected dose, contamination, and airborne radioactivity levels that workers may encounter.

Due to the close proximity of other waste sites, monitoring wells and boreholes, existing utilities, ongoing operations, and waste transfer lines, an analysis of the geographic data was performed. A three-dimensional model of the area was used to evaluate the excavation and barrier footprints. As a result of the evaluation, several interfaces were identified and are now reflected in the remedial design.

The resulting waste from the RA will either be sent to ERDF for disposal or packaged into WIPP-certifiable containers and sent to the Central Waste Complex (CWC) for storage, pending eventual certification, shipment, and disposal at WIPP. Because the cost of waste disposal is expected to be a significant component of the RA, a waste management expert evaluated the waste management approach.

Because of the amount of plutonium expected to be encountered during excavation, alternative soil removal techniques were evaluated. In addition, because of the uncertain structural integrity of the settling tanks, alternative methods for removing sludge from the tanks were explored.

The gathered data were used to establish a viable technical approach using an interdisciplinary team during a facilitated value engineering (VE) workshop. Based on the results of the VE workshop and the selected technical approach, a remedial design was developed, a DQO process was completed, DQOs were established, and the SAP (DOE/RL-2015-22) was prepared.

A work breakdown structure (WBS) was established (Figure 3-1), resulting in five "work packages," or elements that comprise the RA. Narratives describing the scope of each WBS element were developed, bases of estimate were prepared consistent with each WBS narrative, and an integrated critical path schedule of the necessary work activities within each WBS element was generated. The technical approach, cost estimate, and schedule for achieving the RA are described within this document.

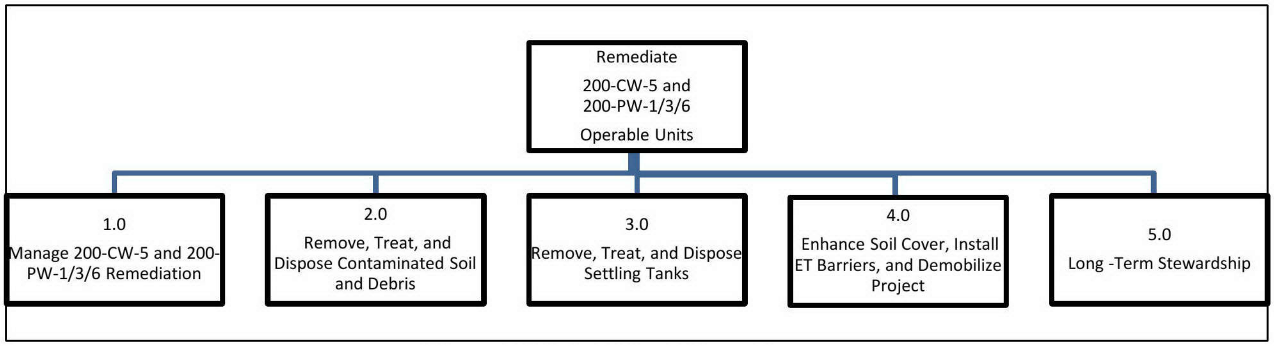

Figure 3-1. Work Breakdown Structure

3.2 Design Basis

The work tasks necessary to remediate the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs are organized into the following five work packages, consistent with the WBS shown in Figure 3-1:

- Manage 200-CW-5 and 200-PW-1/3/6 remediation
- Remove, treat, and dispose of contaminated soil and debris
- Remove, treat, and dispose of settling tanks
- Enhance soil cover, install ET barriers, and demobilize project
- Perform long-term stewardship

3.2.1 Manage 200-CW-5 and 200-PW-1/3/6 Remediation

Project management for remediation of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs begins with project authorization and continues through initiation of long-term stewardship. It includes acquiring the remediation system, mobilizing the project, and turning the system over to the Operations organization.

3.2.2 Remove, Treat, and Dispose of Contaminated Soil and Debris

RTD of contaminated soil and debris from the 200-CW-5, 200-PW-1, and 200-PW-6 OUs includes management and operations of the soil and debris remediation system (SRS) after it is turned over to the Operations organization. Load management and blending/mixing of waste will be used to assure the waste is properly packaged for disposal at ERDF or WIPP. Sampling and verification of cleanup levels are included for contaminated soil and debris sites.

3.2.3 Remove, Treat, and Dispose Settling Tanks

RTD of the settling tanks from the 200-PW-1 and 200-PW-6 OUs includes management and operations of the settling tank remediation system (STRS) after it is turned over to the Operations organization. Load management and blending/mixing of waste will be used to ensure that waste is properly packaged for disposal at ERDF or WIPP. Sampling and verification of cleanup levels are included for the settling tank sites.

3.2.4 Enhance Soil Cover, Install ET Barriers, and Demobilize the Project

Enhancing soil cover, installing ET barriers, and demobilizing the project includes enhancing the soil cover over three of the 200-PW-3 OU waste sites, installing ET barriers over the 200-PW-1 and 200-PW-6 OU waste sites, and demobilizing the remediation project (e.g., installing replacement wells and dispositioning the remediation system).

3.2.5 Long-Term Stewardship

Long-term stewardship for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs includes ICs; surveillance, operations, and maintenance; and CERCLA 5-year reviews.

3.3 Supplemental Design Tasks

SRS and STRS will be acquired in compliance with CERCLA and the Contractor Requirements Document (CRD) for DOE O 413.3B, *Program and Project Management for the Acquisition of Capital Assets*. Implementation of the DOE O 413.3B CRD is an internal DOE requirement that is performed outside the CERCLA process but factors into the cost, schedule, and work scope required to acquire and startup SRS and STRS.

The critical decision (CD) process outlined in the DOE O 413.3B CRD imposes project hold and approval points to review and approve the project's readiness to proceed to the next phase of project execution. The CD process is intended to optimize execution of each project phase while ensuring that risks are managed prior to committing resources to the next phase of project execution. The phases of the CD process include CD-0, Approve Mission Need; CD-1, Approve Alternative Selection and Cost Range; CD-2, Approve Performance Baseline; CD-3, Approve Start of Construction/Execution; and CD-4, Approve Start of Operations.

The CD process will be customized for this project consistent with DOE O 413.3B Section A.5 guidance for Environmental Management (EM) Cleanup Projects. Because the project requirements are driven by CERCLA requirements and the TPA (Ecology et al., 1989a), CDs will be combined (tailored) to match the project's developmental process, which considers the regulatory and legal requirements. For this project, CD-2 and CD-3 will be combined. Adjustments to the system design and operating parameters will occur throughout the lifecycle of this project based on actual system performance against the RAOs.

3.4 Design Approach

The remedial design process will comply with requirements of Section 7.3 of the TPA Action Plan (Ecology et al., 1989b) and will be performed in a phased manner as described in the DOE O 413.3B CRD, consistent with the CD process. A remedial design report (RDR) for both 30 and 90 percent design completion, an air monitoring plan (AMP), and an operations and maintenance (O&M) plan will be developed and submitted to comply with the TPA Action Plan (Ecology et al., 1989b) as identified in Sections 3.4.1 through 3.4.3 of this document, respectively.

The general approach to satisfy the DOE O 413.3B CRD requirements necessary to complete the remedial design process includes the following:

- Develop and submit the project "Mission Need" to obtain CD-0 for this project based on the ROD (EPA et al., 2011) and this RD/RAWP.

- Prepare documentation required to support submittal of the DOE O 413.3B CRD CD packages for DOE approval, as identified in Section 3.4.4, including development and implementation of safety documentation identified in the safety design strategy (SDS). Integrate preparation of CERCLA documentation and other DOE O 413.3B CD deliverables to minimize duplication of effort, optimize cost and schedule, and ensure continued regulatory compliance.
- Select and demonstrate technology for remediation systems.
- Design, procure, construct, install, and test remediation systems, including SRS and STRS.
- Hire and train staff required to remediate the OUs.
- Prepare O&M documentation for the remediation systems.

Construction activities and RTD operations will be conducted, in part, at existing Hazard Category 2 nuclear facilities. The project activities will be managed under the requirements of DOE-STD-1189-2008, *Integration of Safety Into the Design Process*. An SDS document will be prepared and approved during the project definition phase to establish a tailored approach to the application of DOE-STD-1189-2008.

RTD systems will be designed to limit occupational radiation exposures in accordance with 10 CFR 835, "Occupational Radiation Protection," requirements. The following design and control provisions of 10 CFR 835 apply to this RA:

- Avoid releases to the workplace atmosphere.
- Control inhalation by workers to as low as reasonably achievable (ALARA).
- Incorporate the following hierarchy of controls: engineering controls, administrative controls, and personal protective equipment (PPE).

Remote operations are required when operations could expose personnel to high dose rates or generate gross levels of contamination that would result in high derived air concentration levels. Excavation of high-activity TRU soils presents a significant airborne radiological hazard to workers and collocated employees. Plutonium isotopes have very restrictive airborne concentration limits, and numerous personnel and facilities are located in close proximity to these waste sites. At 5 nCi TRU/g or less, local controls are expected to be effective to mitigate the airborne hazards under open-air excavation. It is possible that slightly higher concentrations could be managed in open air with careful controls but not by more than a factor of 2 (10 nCi TRU/g). At TRU waste concentrations of >5 nCi TRU/g, contamination airborne radioactivity levels are expected to be too high to be managed without engineering controls. Design will incorporate use of contamination control structures with ventilation control, as required, to provide the necessary engineered controls. These measures will enable work to be accomplished within the schedule identified in Chapter 7 without exceeding an assumed maximum allocated unabated offsite dose of 0.1 mrem/yr for the project.

To address uncertainties in technology applications associated with RTD of various waste sites, particularly in regard to remote operations and sludge retrieval from the 241-Z-361 Settling Tank, technology selection and demonstration will be achieved through use of prototypes and mockup(s) early in the remediation design process and prior to completion of the 30 percent RDR. Consistent with the DOE O 413.3B CD process, the technology selection will align with development of conceptual design, and a technology readiness assessment will be conducted prior to major expenditure on final system design, procurement, and construction. Mockup(s) will also be used to enhance personnel training, where appropriate.

The design will incorporate measures to achieve operating efficiencies necessary to support the project schedule. Weather enclosures will be incorporated into the design, where needed, to achieve the soil and debris removal rates or protect contamination control structures from the environment. The weather enclosures and contamination control structures will be designed for ease of relocation within work sites and to other work sites.

3.4.1 Remedial Design Report

Per Section 7.3.9 of the TPA Action Plan (Ecology et al., 1989b), DOE will submit an RDR to EPA. The RDR will be submitted at 30 percent design and 90 percent design.

The 30 percent RDR will contain, or include by reference (but is not limited to), the following items:

- Remediation method selection
- Technical data book
  - Existing data and newly acquired data to support the design basis
- 30 percent remedial design
  - Functions and requirements document (FRD)
  - Functional design criteria (FDC)
  - List of design drawings, specifications, and calculations
  - Initial mass balance calculation and process flow diagrams
  - Initial piping and instrumentation diagrams
  - Proposed site plan including locations of equipment/facilities
- Safety input to the design basis
  - Hazard analysis
- Identification of long lead procurements
- Construction budget estimate
- Preliminary construction schedule
- Safeguards and security verification, including special nuclear material sampling requirements in the DQOs
- Transportation requirements
- 90 percent RDR including the following items:
  - Design drawings
  - Specification of construction materials
  - Construction budget estimate
  - Construction schedule

DOE-RL will provide 30 percent and 90 percent remedial designs to the local EPA field office for review. This will include technology development and demonstration, as needed. Summary briefings and discussions may be held at project-specific meetings or other agreed upon forums. Issues will be identified and resolved in a timely manner to prevent or minimize impacts to schedules for issuing requests for proposals. The following process will be followed to implement the preceding requirement for RDR reviews and approval.

- DOE-RL will provide a hard copy of the draft remedial design package and design schedule to EPA at the local field office.
- The EPA review period will be 30 days. If additional review time is necessary, the review period can be increased up to 45 calendar days. To minimize effects to the schedule, the need for additional review time should be communicated early in the process.
- Review comments and issues will be identified and resolved in a timely manner. Review comments and issues, including responses or resolutions, will be documented and agreed upon by both DOE and EPA.
- DOE-RL will transmit a hard copy of the final 100 percent remedial design package and design schedule, with comments incorporated, to the local EPA field office for final approval.

An approval letter should be provided from EPA to DOE-RL within a reasonable time frame. The approval letter should reference the specific design and reference that EPA approval was warranted.

The 30 percent RDR will be developed substantially from the conceptual design report (CDR) and associated documentation supporting CD-1 approval. The 30 percent RDR will be used to support CD-1 approval.

The 90 percent RDR will be integrated with final design and approved prior to CD-4 approval.

3.4.2 Air Monitoring Plans

The substantive requirements applicable to radioactive air emissions resulting from remediation activities are to quantify potential emissions, monitor the emissions, and identify and employ best available radionuclide control technology (BARCT). Exemption from these requirements may be requested if the potential-to-emit (PTE) for the activity or emission unit would result in a total effective dose equivalent of less than 0.1 mrem/yr.

BARCT includes, but is not limited to, dust suppression (e.g., water, water sprays, and fixatives) and the use of other standard engineering controls (e.g., high-efficiency particulate air [HEPA] filter vacuum cleaners). An AMP for the RA activity will be developed to incorporate the preceding requirements and will be transmitted to EPA at the local field office for review and approval. Summary briefings and discussions may be held at unit managers' meetings (UMMs) or other agreed upon forums. Issues will be identified and resolved in a timely manner to prevent or minimize impacts to schedules.

The following process will be followed to implement the preceding requirement for AMP reviews and approval, and may be modified at the UMM:

- DOE-RL will provide the draft AMP and schedule to EPA at the UMM, or deliver it to the local field office or other forums (as agreed upon).
- EPA will provide documented notice to DOE-RL within a timely manner, if approval is warranted.
- The EPA review period is 30 days. If additional review time is necessary, the review period can be increased up to 45 calendar days. To minimize effects to the schedule, the need for additional review time should be communicated early in the process.

- Review comments and issues will be identified and resolved in a timely manner. Review comments and issues, including responses or resolutions, will be documented in the UMM, letters, or other forums (as agreed upon).
- DOE-RL will transmit a hard copy of the final AMP, with comments incorporated, to EPA at the local field office, for final approval.

EPA should provide an approval letter to DOE-RL within a reasonable period. The approval letter should reference the specific AMP and state that EPA approval was warranted.

3.4.3 Operations and Maintenance Plan

O&M of the remediation system(s) will be integrated with any ongoing operations in the immediate vicinity. Process monitoring (e.g., waste, water, materials addition, ventilation flow rate, and contamination concentration in the air) will be defined in the O&M plan.

Process control monitoring includes volume measurements and concentrations of chemicals and isotopes in the retrieved/stabilized waste. Process monitoring data will be used to assess contaminant mass removal and removal effectiveness. Because process control monitoring requirements will be determined as part of remedial design, updates to the O&M plans will occur following remedial design. Process monitoring will be reported as defined in the O&M plan.

The O&M plan will also address waste packaging and transportation activities. The O&M plan is a primary document, as described in Section 7.3.11 of the TPA Action Plan (EPA et al., 1989b), and any revision will be reviewed and approved by the lead regulatory agency. The initial approved O&M plan will be used to support CD-4 approval.

3.4.4 DOE O 413.3B Documents and Activities

The following is a description of the DOE O 413.3B-related documents and activities that are required during each CD phase in order to complete remedial design, acquisition, and startup of SRS and STRS:

CD-0 (Approve Mission Need) Phase

- Justification for mission need documentation developed based on the approved RD/RAWP

CD-1 (Approve Alternative Selection and Cost Range) Phase

- Project execution plan (PEP), including environmental regulatory strategy, tailoring strategy, acquisition strategy, plan for implementation of an Integrated Safety Management System (ISMS), and quality assurance (QA) program requirements
- FRD and FDC
- Initial SDS, including DOE-RL approval, and update after CDR completion
- Preliminary hazard analysis and preliminary fire hazards analysis
- Capital determination and major modification determination
- Plant Forces Work Review and Work Turndown, as applicable, to ensure compliance with WH Publication 1246, *The Davis-Bacon Act, as Amended*, requirements
- Establishment of a contractor integrated project team (IPT) via a project manager approved charter
- Security assessment to establish preliminary security requirements

- Risk management plan
- Project Code of Record
- Siting evaluation and archeological and cultural reviews
- Alternatives analysis and a CDR, which will include the following:
  - Project cost estimate and project schedule
  - Conceptual design, including design detail and content sufficient for RDR development
  - Formal CDR design review, based on CDR design review plan
- Technology selection for remediation, including mockup testing
- Conceptual safety design report (CSDR)
- Contractor Project Review Board (PRB) review after preparation of the completed CD-1 package, based on a PRB review plan
- Support during DOE IPT and technically independent project review (TIPR) team reviews of the CD-1 package
- Support during DOE review of the CSDR and completion of a conceptual safety validation report
- Support during DOE development of an independent cost estimate (or independent cost review)

CD-2/3 (Approve Performance Baseline; Approve Start of Construction/Execution) Phase

- Performance baseline for DOE approval
- Update and approval of PEP, SDS, security requirements, and QA program requirements (as necessary), with DOE review and approval, based on project evolution
- Preliminary and final design (excluding excavation design), which will include the following:
  - Drawings, technical analyses, and construction specifications
  - Formal design review, based on design review plan
- Hazard analysis report, preliminary safety functions document, preliminary safety equipment list, and preliminary documented safety analysis (PDSA)
- Ecological review
- Construction project safety and health and safety plan (HASP)
- Checkout, testing, and commissioning plan in preparation for acceptance and turnover of systems and equipment at CD-4
- Contractor PRB review after preparation of the completed CD-2/3 Package, based on a PRB review plan
- Support for DOE technology readiness assessment, including preparation of technology maturation plan

- Support during DOE IPT and TIPR team reviews of the CD-2/3 package
- Support during DOE review of the PDSA and completion of the associated safety evaluation report

CD-4 (Approve Start of Operation) Phase

- Procurement, construction, and installation of systems and equipment required for remediation operations
- Title III support for construction, procurement, installation, and testing
- Preparation and implementation of documented safety analyses (DSAs) and technical safety requirement documents (and any transportation safety document) consistent with the SDS
- Procedures, work packages, training materials, and all remaining required O&M documentation required to initiate remediation operations
- All regulatory documentation required for start of operations
- Testing (factory acceptance tests, construction acceptance tests, and operational tests), mockups, and dry runs necessary to achieve operational readiness
- Systems/equipment turnover to the Operations organization, including as-built drawings and spare parts
- All other activities required to demonstrate readiness consistent with requirements of DOE O 425.1D, *Verification of Readiness to Start Up or Restart Nuclear Facilities*, and DOE-STD-3006-2010, *Planning and Conducting Readiness Reviews*
- Support during DOE operational readiness review

ICs and long-term monitoring will be required for waste sites in the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs where contamination is left in place that precludes an unrestricted land use. These ICs and land use controls will be required to ensure that activities are consistent with and restricted to the reasonably anticipated future industrial land uses for the Inner Area of the Central Plateau. DOE is responsible for implementing, maintaining, reporting on, and enforcing the ICs and land use controls. Although DOE may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or other means, DOE shall retain ultimate responsibility for remedy integrity and ICs.

The following IC performance objectives are required to be met as part of this RA (land use controls will be maintained at the waste sites until EPA authorizes removal of restrictions where contamination is at levels to allow for unrestricted use and unlimited exposure):

- DOE shall control access to the waste sites to prevent unacceptable exposure of humans to contaminants in the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs. Visitors entering any of these OUs will be required to be badged and escorted.
- DOE shall post and maintain warning signs at the waste sites in these OUs that caution visitors and workers of potential hazards from contaminants below the ground surface.
- In the event of any unauthorized access to the site, DOE shall report such incidents to the Benton County Sheriff's Office for investigation and evaluation of possible prosecution.

- DOE shall prohibit activities that are not industrial in nature along with drilling, excavation, or use of soils at these waste sites.
- DOE shall prohibit use of groundwater, located beneath the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs, for the foreseeable future until drinking water standards are achieved.
- DOE shall maintain the integrity of and prohibit activities that could damage or lessen the performance of required ET caps and soil covers.
- DOE shall report annually on the effectiveness of ICs for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs as specified in DOE/RL-2001-41, or an alternative reporting frequency specified by EPA.
- DOE shall provide notice to EPA at least 6 months prior to any transfer or sale of the land in the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs, so EPA can be involved in discussions to ensure that appropriate provisions are included in the transfer terms or conveyance documents to maintain effective ICs. If it is not possible for DOE to notify EPA at least 6 months prior to any transfer or sale, then DOE will notify EPA as soon as possible but no later than 60 days prior to the transfer or sale of any property subject to ICs. In addition to the land transfer notice and preceding discussion provisions, DOE further agrees to provide EPA with similar notice, within the same time frames, as to federal-to-federal transfer of property. DOE shall provide a copy of executed deed or transfer assembly to EPA.
- DOE shall prevent the development and use of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs for residential housing, elementary and secondary schools, childcare facilities, and playgrounds.
- Land use controls will be maintained as long as the contamination remains at levels that do not allow for unrestricted use and unlimited exposure and shall not be removed without the prior authorization of EPA.

3.4.5 Statutory Determinations

The selected remedy for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs is protective of HHE, complies with federal and state ARARs appropriate to the RA, and is cost effective. The selected remedy also utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. The remedy for these OUs does not satisfy the statutory preference for treatment as a principal element of the remedy because there is no feasible technology to practicably treat radionuclide contamination that will not result in larger volumes, creating greater impracticability for disposal. The amount of waste disposed is a limiting factor since plutonium waste generated at the 200-PW-1 and 200-PW-6 OU waste sites will include TRU waste, which will be disposed of at WIPP. The contaminated soils will be packaged appropriately for onsite disposal at ERDF or offsite disposal at WIPP, as appropriate.

The selected remedy was chosen in accordance with CERCLA, as amended by the *Superfund Amendments and Reauthorization Act of 1986*, TPA (Ecology et al., 1989a), and to the extent practicable, NCP (40 CFR 300). This decision is based on the Administrative Record file for these OUs. The State of Washington, through Ecology, concurs with the selected remedy.

3.5 Remedial Action Objectives

RAOs are site-specific objectives that define the extent of cleanup necessary to achieve the specific level of remediation at the site. Three RAOs are identified in the ROD (EPA et. al., 2011):

- **RAO 1:** Prevent unacceptable risk to human health and ecological receptors associated with radiological exposure to waste, soil, or debris contaminated above risk-based criteria by removing the source or eliminating the pathway.
- **RAO 2:** Prevent unacceptable risk to human and ecological receptors associated with nonradiological exposure to waste, soil, or debris contaminated above risk-based criteria by removing the source or eliminating the pathway.
- **RAO 3:** Control sources of potential groundwater contamination to support the Central Plateau groundwater goal of protecting the beneficial uses of groundwater, including protecting the Columbia River from adverse impacts.

3.6 Remedial Action Goals

The selected remedy is expected to achieve RAOs when RTD of contaminated soils, ET barrier construction, soil cover enhancement, and SVE activities are complete. The final cleanup levels listed in Table 3-1 establish acceptable exposure levels for specific contaminants and exposure pathways that are protective of HHE and groundwater.

3.7 Remedy Performance Monitoring

Performance monitoring will be conducted to evaluate the effectiveness of the RA to attain the cleanup levels identified in the ROD (EPA et al., 2011). Monitoring will be used to assess the different components associated with the RA.

A SAP (DOE/RL-2015-22) has been prepared to meet the monitoring needs for the RA. Data quality objectives (DQOs) were developed as a part of this plan. The SAP (DOE/RL-2015-22) provides a description and schedule of activities, including data management and evaluation methods, to meet the data needs identified in the DQO process.

3.8 Applicable or Relevant and Appropriate Requirement Compliance

ARARs are established in Section 13 (Statutory Determinations) of the ROD (EPA et al., 2011). ARARs are the substantive provisions of any promulgated federal environmental or more stringent state environmental or facility siting standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate for a CERCLA site or action. Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, RA, location, or other circumstance found at a CERCLA site (40 CFR 300.5, "Definitions"). Relevant and appropriate requirements are cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility siting laws. While not legally "applicable" to circumstances at a particular CERCLA site, these requirements address problems or situations sufficiently similar to those encountered at the site that their use is well suited (40 CFR 300.5).

Appendix B provides a summary of the ARARs and how they will be implemented by this RA.

Table 3-1. Final Cleanup Levels for 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OU Soils

COC	Final Cleanup Level	Basis for Cleanup Level[a]	Risk at Cleanup Level
Plutonium-239 and Plutonium-240	765 pCi/g[b]	Human health (industrial use)	Cancer risk $< 1 \times 10^{-4}$ [b,c]
Americium-241	940 pCi/g	Human health (industrial use)	Cancer risk $= 1 \times 10^{-4}$ [c]
Cesium-137	17.7 pCi/g	Human health (industrial use)	Cancer risk $= 1 \times 10^{-4}$ [c]
Radium-226	4 pCi/g	Human health (industrial use)	Cancer risk $= 1 \times 10^{-4}$ [c]
Strontium-90	20 pCi/g	Ecological receptor protection	HQ = 1
Polychlorinated Biphenyl	0.65 mg/kg	Ecological receptor protection	HQ = 1
Boron	0.5 mg/kg	Ecological receptor protection	HQ = 1
Mercury	0.1 mg/kg	Ecological receptor protection	HQ = 1
Carbon Tetrachloride	100 ppmv[d]	Groundwater protection	Excess Lifetime Cancer Risk $= 1 \times 10^{-5}$ [e]
Methylene Chloride	50 ppmv[d]	Groundwater protection	

a. Cleanup levels are based on an industrial land use scenario. When cleanup levels for ecological receptors or groundwater protection were lower than human health protection, the lower value was used as the final cleanup level.

b. The preliminary remediation goal identified in the feasibility studies based on 10^{-4} risk was 2,900 pCi/g for plutonium-239/plutonium-240. However, DOE has agreed to a more conservative value of 765 pCi/g for this RA.

c. Final verification sampling for radiological contaminants at the Z Ditches Waste Group will be evaluated to confirm that the aggregate risk level is less than 1×10^{-4}.

d. Soil vapor concentrations will be further refined and assessed to ensure they are protective of groundwater.

e. DOE will clean up COCs (carbon tetrachloride and methylene chloride) for the 200-PW-1 OU, subject to WAC 173-340, “Model Toxics Control Act—Cleanup,” so the total excess lifetime cancer risk from them does not exceed 1×10^{-5} at the conclusion of the remedy.

COC = contaminant of concern
DOE = U.S. Department of Energy
HQ = hazard quotient
OU = operable unit
ppmv = parts per million by volume
RA = remedial action

4 Remedial Action Management and Approach

Chapter 4 describes the project team, change management, and RA work tasks needed to implement the remedial design described in Chapter 3.

4.1 Project Team

DOE is responsible for cleanup on the Central Plateau. The DOE Central Plateau remediation contractor (CH2M HILL Plateau Remediation Company [CHPRC]) implements the cleanup for DOE and is responsible for planning, coordinating, and executing the RA activities. The lead regulatory agency (EPA) authorizes the work scope in accordance with the TPA (Ecology et al., 1989a) and oversees the work for regulatory compliance.

Lead Agency (DOE)
DOE is the lead agency under CERCLA (delegated by Executive Order 12580, *Superfund Implementation*, the primary authority under Sections 104, "Response Authorities," and 121, "Cleanup Standards") to conduct removal and RAs at DOE facilities. The DOE-RL Waste Management and Decontamination and Decommissioning Division is responsible for remedy implementation of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs; the federal project director for that division reports to the assistant manager for the River and Plateau. The DOE-RL organizational structure is depicted in Figure 4-1.

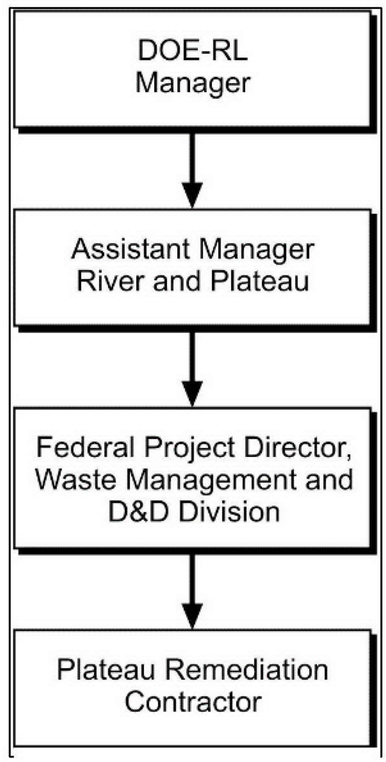

Figure 4-1. DOE-RL Organizational Structure

The DOE-RL Contracting Officer is responsible for authorizing the Central Plateau remediation contractor to perform the remediation tasks for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs.

The federal project director is responsible for obtaining lead regulatory agency approval of the RD/RAWP and SAP (DOE/RL-2015-22), which authorize the RA activities under the TPA (Ecology et al., 1989a). The federal project director also assigns the DOE-RL Technical Lead for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs, who performs the role of the Project Manager identified in Section 4.1 of the TPA (Ecology et al., 1989a). The DOE-RL Technical Lead is responsible for managing the project, day-to-day oversight of contractors performing the RA activities, maintaining regulatory compliance necessary for completion of milestones, and providing technical input to DOE federal project directors.

4.1.1 Lead Regulatory Agency (EPA)

EPA is the lead regulatory agency for CERCLA remediation activities on the Central Plateau. Lead regulatory agency approval will be required on the SAP (DOE/RL-2015-22) and TPA (Ecology et al., 1989a) primary documents (e.g., this RD/RAWP, the RDR, and the O&M plan).

EPA has assigned a project manager who is responsible for overseeing the RA activities for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs. The EPA project manager is responsible for working with DOE-RL to resolve issues and approve the documents in accordance with Articles XIV through XVI of the TPA (Ecology et al., 1989a).

4.1.2 Remediation Contractor (CHPRC)

On October 1, 2008, CHPRC assumed the contract with DOE-RL under which RAs at the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs will be performed. CHPRC performs work under direction of the DOE-RL remedial project manager, assisted by other DOE-RL personnel, as outlined in the following descriptions.

4.1.2.1 CHPRC Project Manager

The CHPRC project manager provides oversight for all contractor activities and coordinates with DOE-RL, the regulators, and primary contractor management in support of remediation activities. The CHPRC project manager ensures that the field construction manager, environmental compliance officer (ECO), sampling coordinator, and others responsible for implementation of regulatory documents are provided with current copies of these documents and any revisions thereto. The CHPRC project manager also works closely with the QA, Occupational Safety and Health (OS&H), Remediation Support (drilling/sampling), and Operations organizations and the field construction manager and engineering lead to integrate these and other lead disciplines in planning and implementing the work scope. The CHPRC project manager coordinates with and reports to DOE-RL, the regulators, and the remediation contractor management on remediation activities.

4.1.2.2 Engineering

All engineering and design work will be performed by qualified engineering staff in accordance with the remediation contractor's engineering procedures (or equivalent standards) using a graded approach. The initial design will be documented in the RDR. The project engineer or engineering lead will be responsible for the remedial design and associated interfaces with the Operations, QA, and OS&H organizations. The Engineering organization will participate in hazards analysis and development of the updated DSA.

4.1.2.3 Operations

The Operations organization includes operating, field engineering, procurement, and maintenance personnel. Operations ensures that the facility and systems are operated and maintained in accordance with applicable requirements and procedures while safely meeting production goals. Responsibilities include system operations; process control; sampling; configuration and work control; modification to systems/facilities; corrective and preventive maintenance; waste management; and support to new system/facility construction, testing, and startup. Operations personnel will be an integral part of the design process, including participation in design reviews, reviews of the associated drawings and specifications, and hazard analysis and safety analysis.

4.1.2.4 Quality Assurance

The QA lead is matrixed to the remediation project manager and is responsible for QA issues on the project. Responsibilities include overseeing implementation of the project QA requirements; reviewing project documents (including the DQO summary report [SGW-58692, *Data Quality Objectives for the 200-CW-5, 200-PW-1, and 200-PW-6 Operable Units*]), SAP (DOE/RL-2015-22), and QA project plan); and participating in QA assessments on sample collection and analysis and other remediation activities, as appropriate. Construction QA personnel will be assigned to the project to oversee the construction and vendor fabrications, including development of QA inspection plans for vendor fabricated equipment.

4.1.2.5 Occupational Safety and Health

OS&H organization responsibilities include coordinating industrial safety and health support within the project as carried out through the HASP, job hazard analyses, and other pertinent safety documents required by federal regulations or primary remediation contractor work requirements. Assistance is provided to project personnel in complying with applicable health and safety standards and requirements. PPE requirements are coordinated with the Radiological Control organization lead. The OS&H organization leads will participate in development of the functional design requirements, as well as the review of drawings and specifications.

4.1.2.6 Field Construction

The field construction manager is responsible for the construction phase of the project, including the management of CHPRC onsite forces, as well as subcontractors and vendor provided work (including offsite fabrications). Responsibilities include day-to-day management of necessary site resources while maintaining the budget and schedule. Organizations that will support the planning, coordination, and execution of field remediation activities include OS&H, Environmental Compliance, QA, Sample Management, Waste Management, and Radiological Control. The field construction manager communicates with the CHPRC project manager to identify field constraints that could affect remediation activities and assists the construction manager in obtaining supporting resources.

4.1.2.7 Environmental Program and Strategic Planning

The Environmental Program and Strategic Planning organization provides support during the development of required regulatory documents, which includes remedy performance evaluation. The Environmental Program and Strategic Planning organization also provides the ECO.

The ECO provides technical oversight, direction, and acceptance of project and subcontracted environmental work and develops appropriate mitigation measures, with the goal of minimizing adverse environmental impacts. The ECO reviews plans, procedures, and other technical documents to ensure that all environmental requirements have been addressed; identifies environmental issues that affect operations and develops compliant and cost effective solutions; and responds to environmental/regulatory issues or concerns raised by DOE-RL and/or the regulatory agencies.

4.1.2.8 Radiological Control

The Radiological Control lead is responsible for radiological/health physics support within the project. Specific responsibilities include conducting ALARA reviews, exposure and release modeling, and radiological controls optimization for all work planning. Radiological hazards are identified, and appropriate controls are implemented to maintain worker exposures to hazards at ALARA levels (e.g., PPE). The Radiological Control organization interfaces with the project OS&H representative and plans and directs radiological control technician support for all activities. The Radiological Control lead will also assist in construction activities that require access to contaminated tanks, piping, or ancillary equipment.

4.1.2.9 Waste Management

The Waste Management lead communicates policies and procedures and ensures project compliance for storage, transportation, disposal, and waste tracking in a safe and cost effective manner. Other responsibilities include identifying waste management sampling and characterization requirements to ensure regulatory compliance and interpreting the characterization data to generate waste designations, waste profiles, and other documents that confirm compliance with waste acceptance criteria.

4.1.2.10 Sample Management

The Sample Management organization coordinates laboratory analytical work, ensuring that the laboratories conform to Hanford Site internal laboratory QA requirements (or their equivalent), as approved by DOE-RL and EPA. The Sample Management organization receives analytical data from the laboratories, performs data entry into the Hanford Environmental Information System database, and arranges for data validation. The Sample Management organization is responsible for informing the project manager of any issues reported by the analytical laboratory, and also works with the project manager to prepare characterization reports on the sampling and analysis results, as needed. Additional related responsibilities include developing the DQOs and SAP, including the sampling design, coordinating field sampling, and resolving technical issues.

4.2 Change Management

Three types of changes in the RA could affect compliance with the requirements in the ROD (EPA et al., 2011): a nonsignificant or minor change, a significant change to a component of the remedy, and a fundamental change to the overall remedy.

A nonsignificant or minor change does not impact the remedy identified for the waste sites in the 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 OUs ROD (EPA et al., 2011). An example of a nonsignificant change may include modifications to the RA schedule that do not impact an agreed-upon milestone. Minor changes should be documented in the appropriate post-decision project file (e.g., through interoffice memoranda or in logbooks) or project manager's meeting minutes.

It may be determined that a significant change to the selected remedy, as described in the ROD (EPA et al., 2011) is necessary. Significant changes are defined as changes that significantly modify the scope, performance, or component cost for the remedy as presented in the ROD (EPA et al., 2011). All significant changes will be addressed in an explanation of significant differences.

A fundamental change is a change that does not meet the requirements set forth in the ROD or that incorporates remedial activities not defined in the scope within the ROD (EPA et al., 2011). Should this situation arise, the ROD (EPA et al., 2011) must be amended.

Determining whether a change is significant or fundamental is the lead regulatory agency's responsibility, with input and consultation from DOE-RL. The project manager is responsible for tracking all changes and obtaining appropriate reviews by staff. The project manager will discuss the changes with DOE-RL, followed by discussions with EPA.

4.3 Remedial Action Work Tasks

The following description includes the scope, deliverables, assumptions, requirements, interfaces, and completion criteria for each of the RA work tasks.

4.3.1 Manage 200-CW-5 and 200-PW-1/3/6 Remediation

Management of the 200-CW-5 and 200-PW-1/3/6 remediation begins with project authorization and continues through initiation of long-term stewardship. The following sections describe the scope, deliverables, assumptions, requirements, interfaces, and completion criteria for this task.

4.3.1.1 Scope

Project management for remediation of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs includes acquiring the remediation system, mobilizing the project, and turning the system over for operations. Specifically, the scope includes the following tasks:

- Prepare applicable project management and environmental documentation per DOE orders and federal regulations.
- Provide guidance and direction through project initiation to project demobilization and closeout.

- Coordinate interfaces (e.g., DOE-RL and regulator document reviews, project readiness review, Defense Nuclear Facilities Safety Board, CWC, tank farms, utilities, other ongoing operations, safeguards, and groundwater monitoring).
- Manage the project in accordance with the Earned Value Management System (act as control account manager, develop project schedules, and track and report on project performance).
- Acquire the remediation system(s) for the 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 OUs (e.g., hire and train staff, follow CRD for DOE O 413.3B [including design, procurement/ construction/installation/testing of remediation systems], submit quarterly startup notification report, prepare operating procedures [integrate nuclear safety, criticality safety, radiological controls, industrial hygiene, occupational safety, environmental compliance, air monitoring program, and waste management], and demonstrate readiness).
- Mobilize the project (e.g., complete supplemental ecological reviews, set up construction facilities, survey pipelines and grade, complete ground-penetrating radar [GPR] and other subgrade investigations, decommission wells, locate and isolate utilities, install temporary utilities, isolate waste transfer lines, set up haul routes, set up traffic detours, install construction fences, set up container staging and preparation areas, set up assay equipment, and set up air monitoring system).

Equipment and design for the remediation system will be finalized after completion of an alternative analysis, technology selection and demonstration, and conceptual design phase of the project. The following major components will be acquired for the remediation system:

- Relocatable tension fabric weather enclosures for work at all cribs, ditches, and tanks from the point that clean overburden is removed at the specific location until after waste removal and application of a layer of soil or fixative at that specific location. This excludes work at the 216-Z-20 Tile Field and the Cesium-137 Waste Group. The weather enclosures will not be relied upon for confinement of radiological releases but will include ventilation for removal of exhaust fumes and for general environmental control. Each assembled weather enclosure will have approximate dimensions of 73 m (240 ft) long by 54.8 m (180 ft) wide and 13.7 m (45 ft) high in the middle (6 m [20 ft] high on sides). A typical weather enclosure, after installation, is depicted in Figure 4-2. A total of six weather enclosures will be provided to achieve required remediation rate within work clusters as follows:
  - Z Ditches (216-Z-1D Ditch, 216-Z-11 Ditch, 216-Z-19 Tile Field, and UPR-200-110 Trench) and 216-Z-5 Crib
  - 241-Z-8 Settling Tank (including the 216-Z-8 French Drain) and 216-Z-9 Trench
  - 216-Z-12 Crib
  - 216-Z-18 Crib
  - 216-Z-1A Tile Field, 216-Z-1 Crib, 216-Z-2 Crib, 216-Z-3 Crib, and 241-Z-361 Settling Tank

Two weather enclosures will be used at a time for larger cribs and trenches to enable multiple moves of contamination control structures without relocation of a weather enclosure each time.

- Relocatable, modular contamination control structures for work at all locations where dictated for radiological control. During operations, the contamination control structure will be located inside a weather enclosure.

Figure 4-2. Typical Weather Enclosure

- Each contamination control structure will serve as a confinement barrier with a ventilation system that maintains airflow from the weather enclosure into the contamination control structure prior to HEPA filtered exhaust from the contamination control structure during RTD operations. The ventilation exhaust system will be skid mounted for ease of relocation and will include two HEPA filters in series. The ventilation system will comply with applicable DOE requirements for nuclear confinement systems, such as ASME AG-1-2012, *Code on Nuclear Air and Gas Treatment*.
- Each contamination control structure will include airlock(s) for personnel and equipment access and a waste load-out station that enables loading of low-level waste (LLW) and TRU waste into packages positioned external to the enclosure while maintaining containment of the wastes during the loading operations. A total of six contamination control structures (46 m [150 ft] wide by 37 m [120 ft] long) will be provided to achieve the desired remediation rates that support the project schedule. A typical contamination control structure is shown in Figure 4-3. This specific structure was used at the Hanford Site T Plant.
- A system (grouting or alternative) for immobilizing remaining contamination within the 241-Z-8 Settling Tank, size reducing the tank within a contamination control structure, retrieving and packaging the size-reduced tank into compliant waste package, and removing the waste package.
- A system and equipment for RTD of the 241-Z-361 Settling Tank. If sludge must be removed prior to tank removal, as determined during technology demonstration, a sludge retrieval system will be provided that includes a process enclosure to provide an engineered barrier for personnel protection during sludge removal and during processing operations until the sludge is sufficiently stabilized. The process enclosure ventilation will be integrated with the contamination control structure ventilation and will maintain air flow from the process enclosure through the 241-Z-361 Settling Tank to a HEPA-filtered exhaust system.

Figure 4-3. Contamination Control Structure at T Plant

- Due to tank integrity concerns, pilings will be placed around the tank and lagging will be added, as necessary, during excavation. The process enclosure will be installed on an exposed face of the tank after sufficient excavation around the tank. Penetration(s) into the tank will enable transfer of sludge, utilizing the sludge retrieval system, from the tank into the process enclosure.
- Equipment and systems will be provided in the process enclosure for the sludge to be transferred into a trough and grouted and for the grouted sludge to be dried, assayed, and mechanically size reduced for loading into waste packages, and then loaded into waste packages. Equipment will be provided for tank size reduction, assuming a sufficient amount of sludge is removed from the tank during RTD operations to enable safe size reduction of the tank within the contamination control structure.
- Equipment will be provided to support waste packaging based on disposal of tank and contents at WIPP. Capability will be provided to apply fixative to tank interior surfaces to minimize contamination spread during tank size reduction and removal. The 241-Z-361 Settling Tank with installed process enclosure is depicted in Figure 4-4. The cutaway provides a perspective of the estimated sludge depth within the tank.
- Alternatively, if WIPP criteria can be satisfied and technology demonstrated to be viable, cost effective, and safe, the top of the tank will be removed, a stabilization material (e.g., grout) will be added and mixed with the sludge, and the tank size will be reduced and packaged for disposal at WIPP with the tank contents. This operation would be conducted within a contamination control structure. If this option were implemented, the process enclosure would be eliminated.

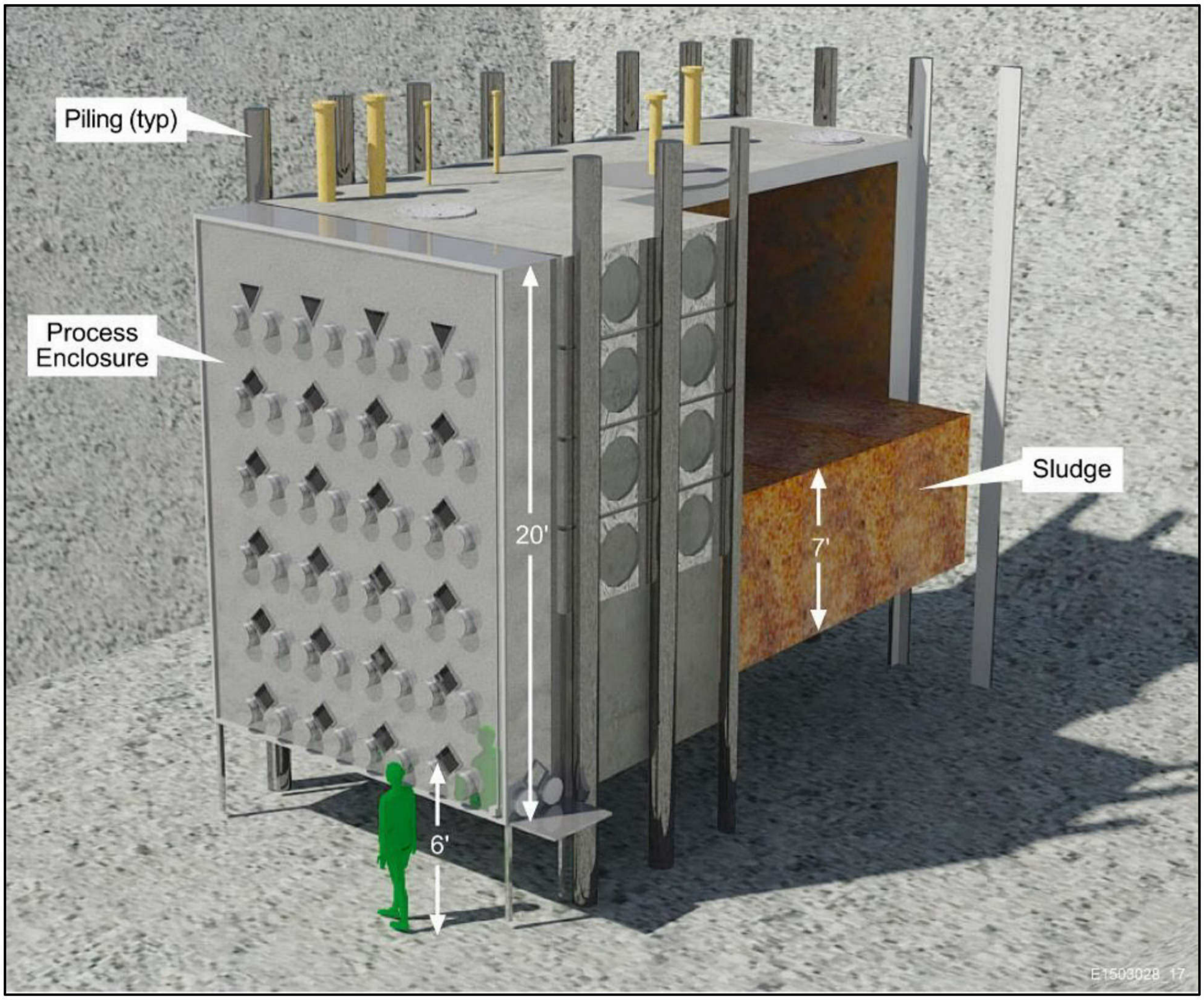

Figure 4-4. Cutaway of 241-Z-361 Settling Tank

- Tools, vehicles, and equipment (e.g., excavators, tools to break up cobble and soil and lift the waste [e.g., clamshell], assay, and container movement system) necessary for RTD operations and ET barrier installations. Spare equipment will be provided, as necessary, to support start of operations. Assay equipment will be sufficient to ensure that waste materials are appropriately classified consistent with DOE/WIPP-02-3122, *Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant*, and WCH-191, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*, prior to loading into the specific waste package.
- Support facilities (e.g., trailers) required for radiological control, maintenance, and operations during RTD operations and ET barrier installations.
- Initial complement of empty waste packages for the first 6 months of RTD operations.

Activities that will be conducted to mobilize the project prior to start of RTD operations include the following:

- Install temporary utilities to support RTD operations. Locate and isolate or relocate existing utilities that create interferences with RTD operations.
- Set up construction and operation trailers.
- Perform cultural and ecological reviews.
- Perform a survey to locate pipelines and, where applicable, isolate or relocate waste transfer lines.
- Grade general areas.
- Perform GPR and other subgrade investigations.
- Decommission wells and boreholes within the waste sites or that would later be under the ET barrier boundary. An example of well and borehole locations within a site (216-Z-1A Tile Field) is depicted in Figure 4-5.
- Set up haul routes and traffic detours to enable movement of personnel, equipment, and materials into and out of the RTD operations areas and for removal of waste packages to ERDF and CWC.
- Install fences to control access to construction sites and, where necessary, for radiological control.
- Set up container staging and preparation areas.
- Set up assay equipment.
- Set up an air monitoring system.

4.3.1.2 Deliverables

Deliverables for this task are as follows:

- All deliverables required to comply with the TPA Action Plan (Ecology et al., 1989b) through demonstration of operational readiness, as identified in Sections 3.3.1 through 3.3.3 of this document (e.g., RDR and O&M plan)
- All deliverables required by DOE-STD-1189 through demonstration of operational readiness (e.g., safety design strategy; hazards analyses, fire hazards analyses, and DSAs)
- All deliverables required by DOE O 425.1D and DOE-STD-3006-2010 through demonstration of operational readiness (e.g., quarterly startup notification and operational readiness review)
- Necessary systems, equipment, and area improvements to remediate the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs
- Component closure plans for the TSD line (200-W-178-PL)
- Cultural and ecological resource reviews
- Asbestos and beryllium inspections
- Project site ready for operations

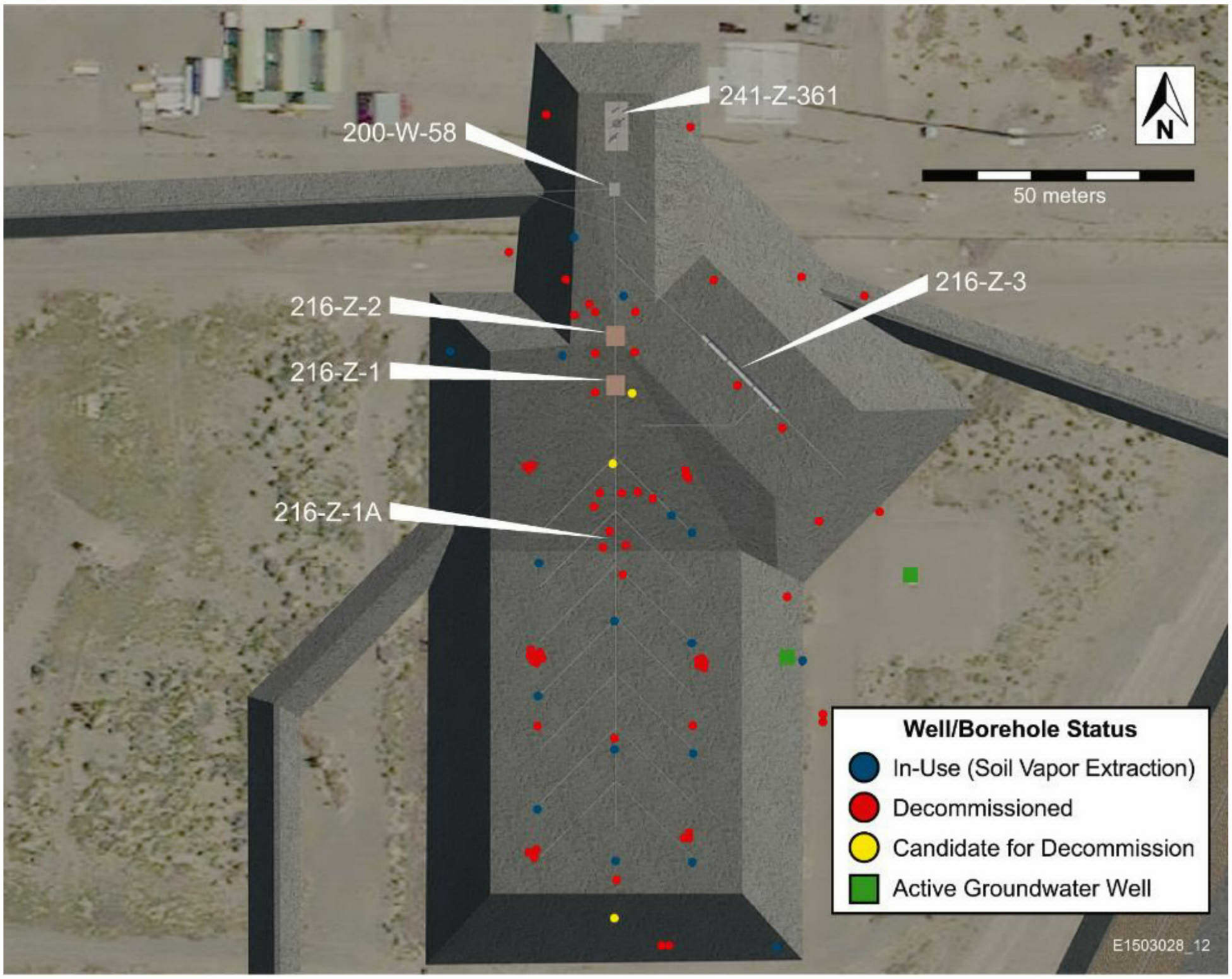

Figure 4-5. Excavated 216-Z-1 Cluster with Wells and Boreholes

4.3.1.3 Assumptions

Specific assumptions for this task are as follows:

- A maximum of 0.1 mrem/yr will be allocated for the project's unabated offsite dose.
- Plutonium Finishing Plant (PFP) Closure Project activities will be completed prior to starting fieldwork for 200-CW-5, 200-PW-1, and 200-PW-6 OU remediation.
- Due to the plutonium inventory, this project will involve Category 2 nuclear facilities.
- This project will involve a major system acquisition, and all of the DOE O 413.3B CDs will be required.
- Pilot testing and mockups of TRU waste retrieval and packaging will be conducted due to material characteristics and requirements for remote operations.
- A DOE operational readiness review will be required.

- Wells within an excavation footprint or ET barrier footprint will be decommissioned. A total of 399 wells will be required to be decommissioned and not relocated. A total of 87 wells will be decommissioned that will be relocated during project demobilization.
- Active utilities within an excavation footprint or ET barrier footprint will be isolated and relocated as determined by the organization responsible for utilities management.
- Active waste transfer lines within an excavation footprint or ET barrier footprint will be isolated and relocated as determined by the organization responsible for the transfer line.
- All radiological samples will be screened onsite prior to shipping for analysis. Samples containing greater than 2g (0.07 oz) of plutonium will be sent to the 222-S Laboratory. Other samples will be sent to commercial laboratories, if practical.

4.3.1.4 Requirements

Requirements for this work package are established in the following laws, regulations, and DOE orders and standards:

- 10 CFR 71, "Packaging and Transportation of Radioactive Material"
- 10 CFR 835, "Occupational Radiation Protection"
- 10 CFR 851, "Worker Safety and Health Program"
- 10 CFR 1021, "National Environmental Policy Act Implementing Procedures"
- CRD for DOE M 460.2-1A, Radioactive Material Transportation Practices Manual for Use with DOE O 460.2A
- CRD for DOE O 413.3B, Program and Project Management for the Acquisition of Capital Assets
- CRD for DOE O 425.1D, Verification of Readiness to Start Up or Restart Nuclear Facilities
- CRD for DOE O 426.2, Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities
- CRD for DOE O 460.1C, Packaging and Transportation Safety
- DOE/RL-2001-36, *Hanford Sitewide Transportation Safety Document*
- DOE-STD-1189-2008, *Integration of Safety Into the Design Process*
- DOE/WIPP-02-3122, *Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant*
- HNF-EP-0063, *Hanford Site Solid Waste Acceptance Criteria*
- WCH-191, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*

A summary of the requirements that are applicable to this scope of work is in Appendix B.

4.3.1.5 Interfaces

Successful execution of activities within this task requires interface with various Hanford Site and non-Hanford Site organizations. The interfaces for this task are included in Table 4-1.

Table 4-1. Manage 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs Remediation Interfaces

Initiator	Receiver	Interface Description
Remediation Project	DOE-HQ	CD-0, Approve Mission Need
Remediation Project	DOE-HQ	CD-1, Approve Alternative Selection and Cost Range
Remediation Project	DOE-HQ	CD-2, Approve Performance Baseline
Remediation Project	DOE-HQ	CD-3, Approve Start of Construction/Execution
Remediation Project	DOE-HQ	CD-4, Approve Start of Operations or Project Completion
Remediation Project	DOE-RL	Safety Design Strategy
Remediation Project	DOE-RL	PDSA
Remediation Project	DOE-RL	DSA
DOE-RL	EPA	RDR for review and approval
EPA	DOE-RL	Approve RDR
DOE-RL	EPA	O&M plan for review and approval
EPA	DOE-RL	Approve O&M plan
DOE-RL	EPA	AMP for review and approval
EPA	DOE-RL	Approve AMP
DOE-RL	Remediation Project	Reviews and approvals
Waste Services	Remediation Project	Waste services – includes transportation safety

AMP = air monitoring plan
CD = critical decision
DOE-HQ = U.S. Department of Energy-Headquarters
DOE-RL = U.S. Department of Energy-Richland Operations Office
DSA = documented safety analysis
EPA = U.S. Environmental Protection Agency
O&M = operations and maintenance
OU = operable unit
PDSA = preliminary documented safety analysis
RDR = remedial design report

4.3.1.6 Completion Criteria

At the completion of this task, the following criteria will have been met:

- RDR will be prepared and approved.
- O&M plan will be prepared and approved.
- SRS will be installed and ready for operations.
- STRS will be installed and ready for operations.
- The project will be mobilized and ready for operations.

Readiness for operations will be achieved when authorization authority approval is received to commence operations after successful demonstration of readiness per the requirements of DOE O 425.1D.

4.3.2 Remove, Treat, and Dispose of Contaminated Soil and Debris

RTD of contaminated soil and debris from the 200-CW-5, 200-PW-1, and 200-PW-6 OUs begins with preparing the sites and continues through backfill and revegetation (except for the waste sites that will be covered with an ET barrier). The following subsections describe the scope, deliverables, assumptions, requirements, interfaces, and completion criteria for this task.

4.3.2.1 Scope

RTD of contaminated soil and debris from the 200-CW-5, 200-PW-1, and 200-PW-6 OUs includes management and operations of the SRS after it is turned over for operations.

RTD operations will be conducted using contamination control structures, if required for radiological control (assumed to be areas with TRU contamination levels greater than 5 nCi/g), and weather enclosures. RTD operations will be sequenced to minimize the amount of operations that must be conducted under the contamination control structures in order to limit the amount of remote operations and the total time for relocation of contamination control structures. This will generally be accomplished by targeting areas of TRU contamination determined to be greater than 5 nCi/g and then releasing remaining work at that location to be conducted without a contamination control structure. Prior to removing a contamination control structure from a work location, that location will be sampled per the SAP (DOE/RL-2015-22), and a sufficient layer of backfill or fixative will be applied for release of the area by Radiological Control for subsequent operations without the use of a contamination control structure. This approach will allow for more efficient nonremote operations over the remaining nontargeted areas and also better facilitate loading of a greater amount of material into more economical waste packages for later disposal. The system for controlling contamination during excavation in locations within a crib, trench, or ditch with areas greater than 5 nCi TRU/g is depicted in Figure 4-6. The figure shows a partial contamination control structure when positioned under two weather enclosures.

An example of plutonium distribution within a waste site (216-Z-1A Tile Field, 216-Z-1 Crib, and 216-Z-2 Crib) is shown in Figure 4-7. The plan view provides a ground surface outline of the waste site with a bottom of the waste site view of the modeled contaminant extent. The topography is transparent in the plan view in order to see the plume. The plutonium distribution for the 216-Z-9 Waste Site is depicted in Appendix A.

RTD operations will use radiation detection equipment mounted to excavators and assay stations located in proximity to waste packaging areas, such as equipment shown in Figures 4-8 and 4-9, to facilitate early and rapid determination of contamination levels. This will support determinations by Radiological Control of when contamination control structures are no longer required at a work site and by Operations on which waste package type to use prior to waste package loading. RTD operations includes required maintenance and calibration of both local and remote radiation detection equipment and assay stations.

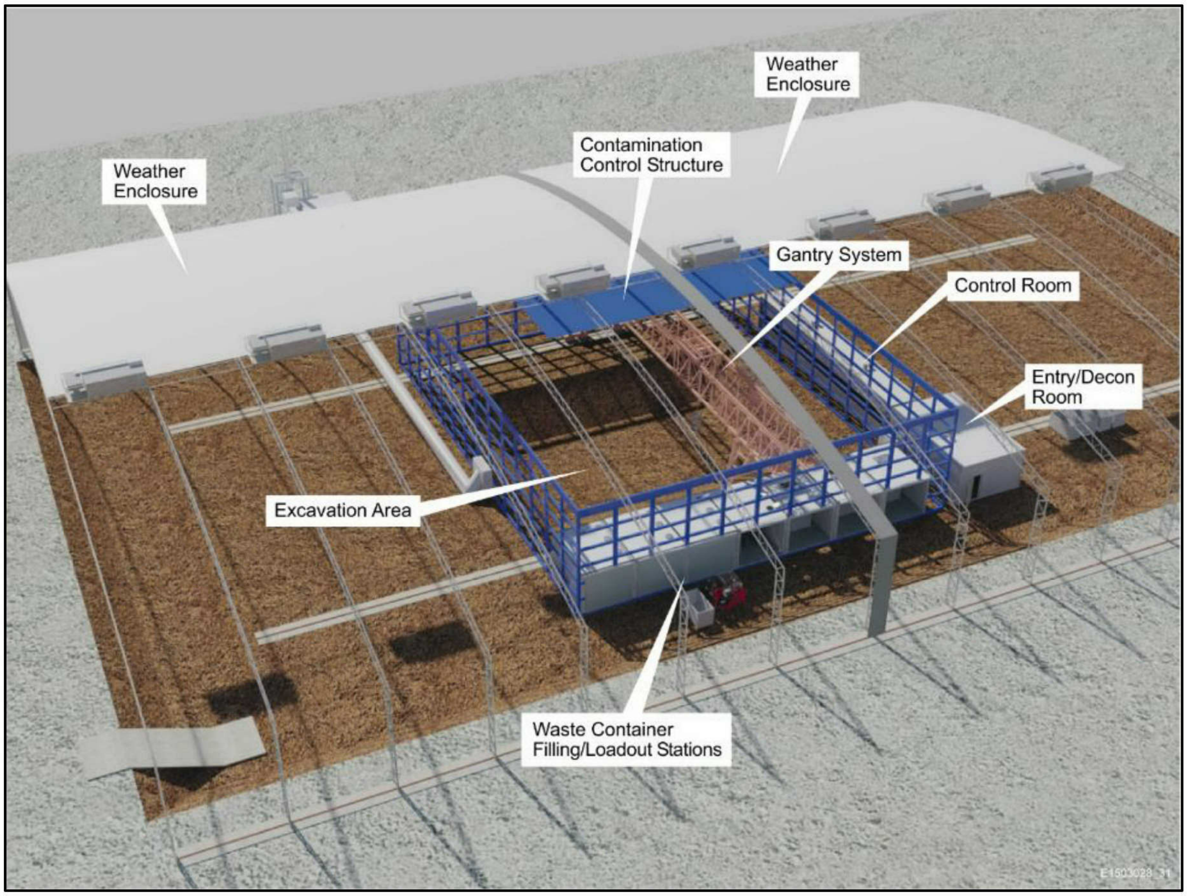

Figure 4-6. Configuration of Contamination Control System

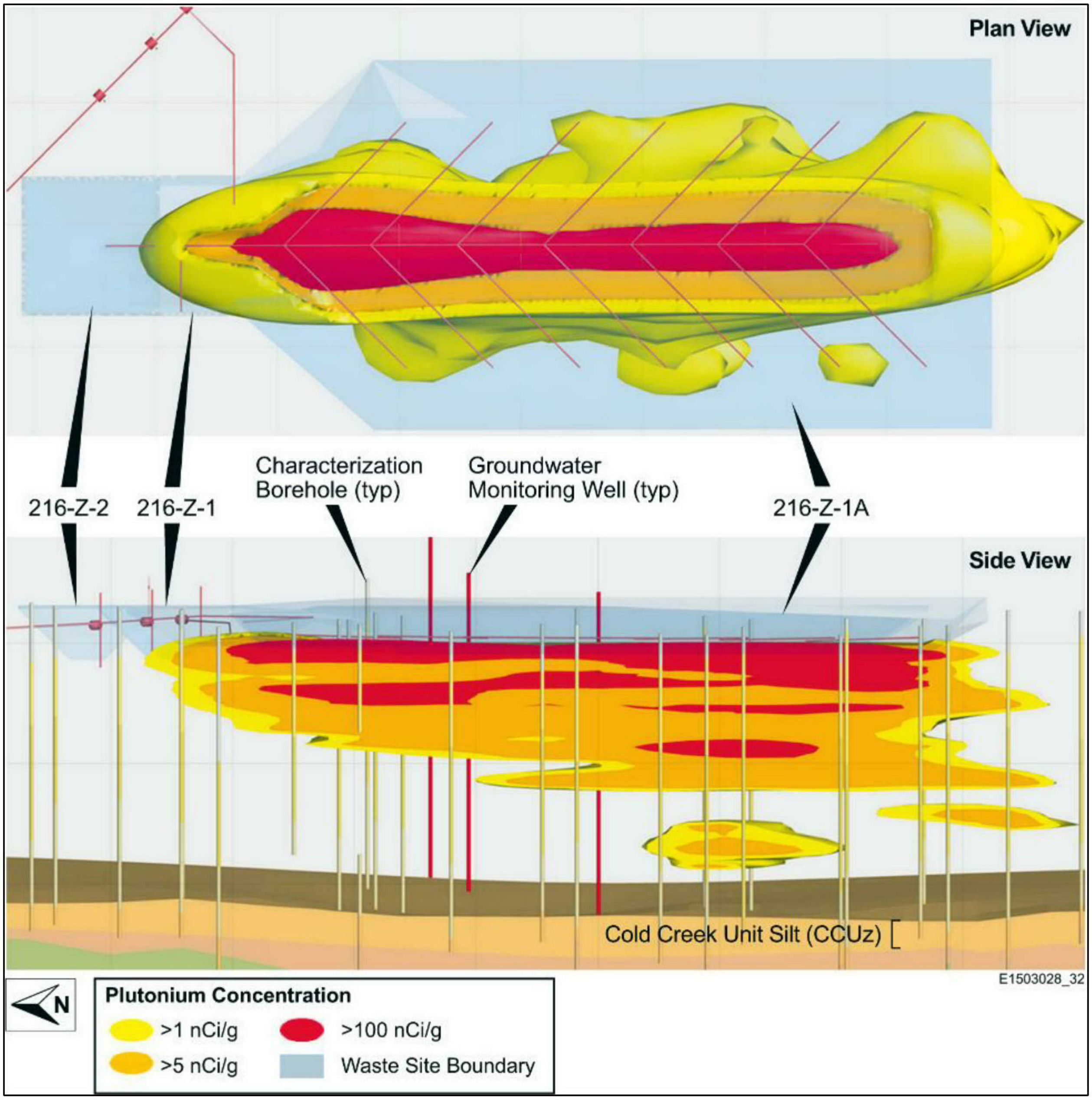

Figure 4-7. 216-Z-1A Plutonium Contamination Distribution

Figure 4-8. Radiation Detection on Excavator

Figure 4-9. Quick Scan Assay

The scope of RTD of contaminated soil and debris includes the following:

- Manage RTD of contaminated soil and debris:
- Provide facility management and internal oversight.
- Maintain safety bases, including DSAs and technical safety requirements.
- Provide technical staff for waste profiling and waste shipping.
- Acquire waste containers beyond the initial 6-month complement provided prior to start of RTD operations, as necessary to complete RTD of soil and debris.
- Prepare to remove contaminated soil and debris:
- Design excavation areas.
- Survey and stake out excavation areas.
- Stabilize excavation areas with cave-in or subsidence potential.
- Remove structures or debris.
- Clear and grub excavation areas at waste sites.
- Grade fields (prepare for work) at waste sites.
- Remove overburdens pending use for backfill or dust control.
- Position weather enclosures over the excavation areas.
- If required for radiological control, locate and assemble contamination control structures over the excavation areas.
- Verify that ventilation systems are in place and operating.
- Prepare containers.
- Stage equipment and supplies at dig sites.
- Remove Waste Pipelines 200-W-174-PL, 200-W-178-PL, 200-W-206-PL, 200-W-207-PL, 200-W-208-PL, and 200-W-210-PL to the project boundary:
- Excavate sufficiently for pipeline removal operation.
- Disposition soil as TRU or LLW based on assay. TRU waste will be packaged for disposal at WIPP. LLW will be packaged for disposal at ERDF.
- Perform external survey of pipelines to determine waste packaging requirements.
- Introduce fixatives into pipeline in areas where pipelines will be severed to control contamination spread during size-reduction (i.e., sawing) operations.
- Size reduce pipelines sufficiently to fit into waste disposal containers.
- Cap and blank remaining segments of the pipeline at the point where they are severed.

- Package pipeline sections into waste containers for disposal at WIPP or ERDF, and perform verification assay.
- Sample excavated site to confirm that contamination levels are within acceptable limits within the top 4.6 m (15 ft) of the excavation.
- Provide sample data to DOE-RL and EPA. When authorized by DOE-RL and EPA, backfill excavated sites.
- Use greenhouses and local contamination control features as necessary, particularly during operations that breach the pipelines.
- RTD of soil and debris with >5 nCi TRU/g, using contamination control structure and weather enclosure as identified in Section 3.3:
  - Remove existing structures or debris.
  - Separate TRU debris from LLW debris based on measurements from field radiological survey equipment.
  - Package for either ERDF or WIPP disposal.
  - Remove soil.
  - Separate TRU soil from LLW soil based on measurements from field radiological survey equipment.
  - Package for either ERDF or WIPP disposal.
  - Confirm that waste is LLW, or confirm that waste is TRU using field-deployed nondestructive assay equipment.
  - Ship waste to either ERDF or CWC.
- RTD of soil and debris with <5 nCi TRU/g, using weather enclosure without contamination control structure as identified in Section 3.3:
  - Remove existing structures or debris and prepare for ERDF disposal.
  - Remove soil and prepare for ERDF disposal.
  - Ship waste to ERDF.
  - Sample excavated waste sites per the SAP (DOE/RL-2015-22).
  - Sample results will be evaluated and provided to DOE-RL and EPA.
  - Pad in enough fill for contamination control prior to removal of weather enclosure or contamination control structure, as applicable.
  - When authorized by DOE-RL and EPA, backfill excavated waste sites.
- Revegetate the following waste sites: 216-Z-1D Ditch, 216-Z-11 Ditch, 216-Z-19 Ditch, 216-Z-20 Tile Field, and UPR-200-W-110.

The preceding sequence will be reiterated, as necessary, until completion of RTD of the contaminated soil and debris waste sites identified.

The total area that will be excavated, excluding the Cesium-137 Waste Group, is shown in Figure 4-10.

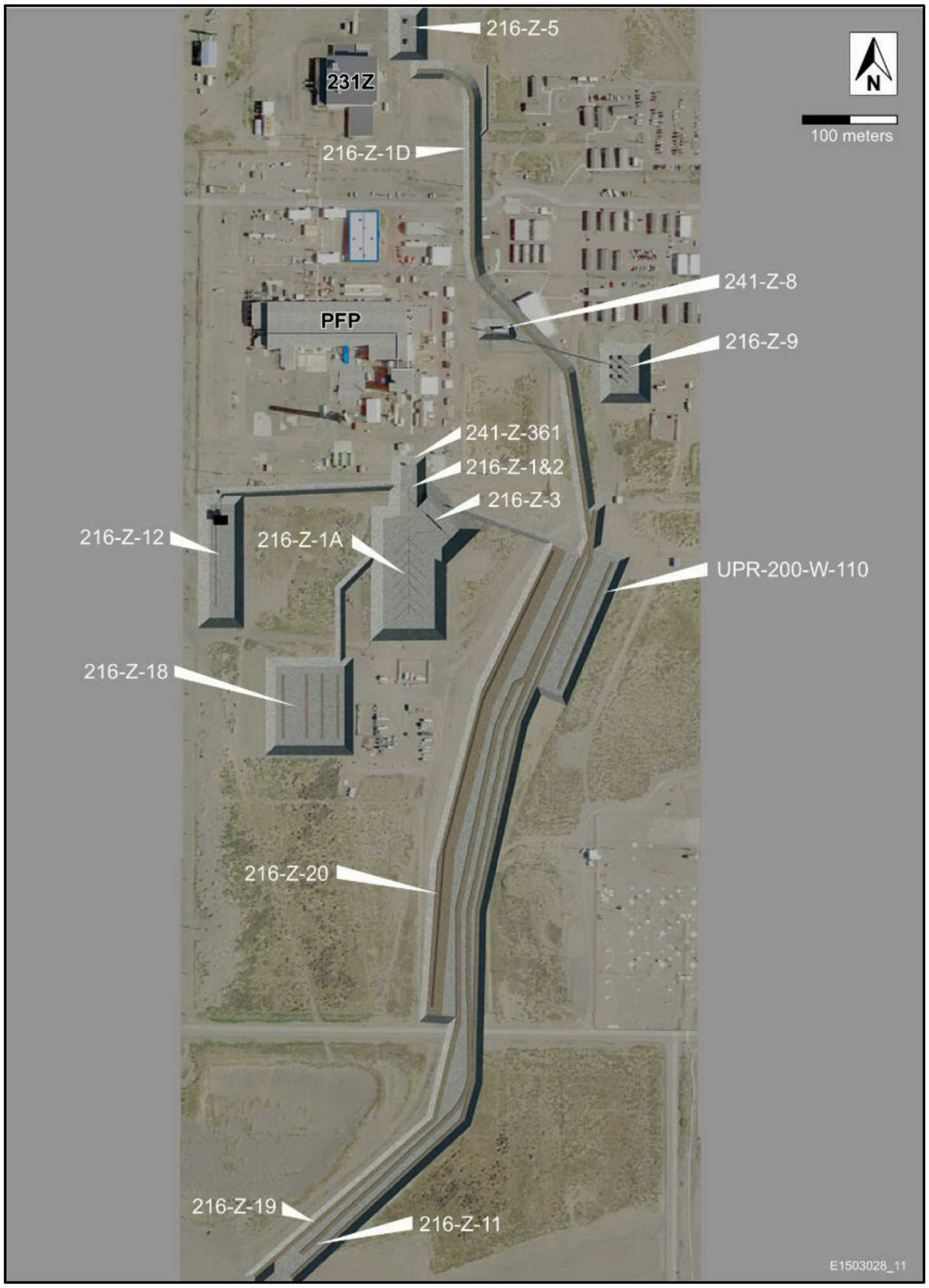

Figure 4-10. Excavation Footprint

4.3.2.2 Deliverables

Deliverables for this task are as follows:

- The following waste sites will be excavated to the specified depths, sampled and characterized per the SAP (DOE/RL-2015-22), and backfilled and revegetated:

  - 216-Z-1D Ditch excavated to a depth of 4.6 m (15 ft) bgs
  - 216-Z-11 Ditch excavated to a depth of 4.6 m (15 ft) bgs
  - 216-Z-19 Ditch excavated to a depth of 4.6 m (15 ft) bgs
  - 216-Z-20D Tile Field excavated to a depth of 4.6 m (15 ft) bgs
  - UPR-200-W-110 excavated to a depth of 4.6 m (15 ft) bgs
- The following waste sites will be excavated to the specified minimum depth, sampled and characterized per the SAP (DOE/RL-2015-22). Further excavation to remove additional plutonium from the waste site will be evaluated by DOE-RL and EPA, based on criteria to be developed at that time. When excavation is completed, the sites will be sampled (if needed), backfilled, and prepared for ET barrier installation:
  - 216-Z-1A Tile Field excavated to a minimum depth of 6 m (20 ft) bgs
  - 216-Z-9 Trench excavated to a minimum depth of 7 m (23 ft) bgs
  - 216-Z-18 Crib excavated to a minimum depth of 6 m (20 ft) bgs
- The following waste sites will be excavated to the specified depths, sampled and characterized per the SAP (DOE/RL-2015-22), and backfilled and prepared for ET barrier installation:
  - 216-Z-1 Crib excavated to a depth of 7.6 m (25 ft) bgs
  - 216-Z-2 Crib excavated to a depth of 7.6 m (25 ft) bgs
  - 216-Z-3 Crib excavated to a depth of 10 m (33 ft) bgs
  - 216-Z-5 Crib excavated to a depth of 6.7 m (22 ft) bgs
  - 216-Z-12 Crib excavated to a depth of 7.3 m (24 ft) bgs
- TRU waste from RTD soil and debris operations staged at CWC pending certification and shipment to WIPP
- LLW from RTD soil and debris operations disposed at ERDF
- Pipelines (200-W-174-PL, 200-W-178-PL, 200-W-206-PL, 200-W-207-PL, 200-W-208-PL, and 200-W-210-PL) removed to the project boundary and capped or blanked

4.3.2.3 Assumptions

Specific assumptions for this task are as follows:

- A bgs measurement indicates below ground surface as of 2015.
- The 216-Z-1A Tile Field, 216-Z-9 Trench, and 216-Z-18 Crib will be excavated to the specified depths of 6 m (20 ft) bgs, 7 m (23 ft) bgs, and 6 m (20 ft) bgs, respectively. The outcome of the evaluation by DOE-RL and EPA, based on post-excavation sample analyses results, will determine if additional excavation is required at these waste sites. Criteria will be developed in time to guide the decision.

- Nitrate and technetium-99 sample analysis results will confirm that levels of these contaminants do not pose an unacceptable risk to the groundwater; therefore, additional remedies are not required to address these contaminants.
- Weather enclosures will be relocated 59 times for RTD soil and debris operations.
- Contamination control structures will be relocated 69 times for RTD soil and debris operations.
- Waste containers will be direct loaded to the extent practical.
- Waste sites with cave-in potential will be stabilized prior to retrieval (e.g., the 216-Z-5 Crib).
- Sections of pipelines that could be under a project waste site barrier will be removed from within at least 7.6 m (25 ft) outside of the barrier boundary. Pipelines and other components that connect to a project waste site will be removed and disconnected or blanked at the project boundary. Associated diversion boxes (200-W-58 and 200-W-59) will also be removed. No remaining pipelines will cross a barrier boundary.
- Overburden soil will be stockpiled and reused.
- TRU waste will be packaged to comply with the current (May 2015) WIPP waste acceptance criteria (DOE/WIPP-02-3122).
- TRU soil and debris will not require treatment to meet the current (May 2015) WIPP waste acceptance criteria (DOE/WIPP-02-3122).
- TRU waste will be stored at CWC pending certification and shipment to WIPP. The cost for certification, shipment, and disposal will be included in the project estimate to be consistent with the ROD (EPA et al., 2011) estimate.
- Pending public involvement and a change to the ROD (EPA et al., 2011), a site-specific treatment variance will be implemented that will exempt the project from treating LLW waste prior to disposal at ERDF.
- LLW will be prepared and packaged to comply with the current (May 2015) ERDF waste acceptance criteria (WCH-191). A Site-Specific Treatment Variance will be successful that will not require the project to treat the waste.
- Glass block in the 216-Z-12 Crib is LLW and will be size reduced before loading into waste packages.

The estimated waste volumes and number of waste packages that will be generated during RTD of the contaminated soil and debris sites and associated pipelines are listed in Table 4-2. These volumes are based on existing models developed from waste site characterization. These volumes do not consider mixing of soil or debris containing greater than and less than 5 nCi of TRU/g. Mixing during excavation will occur and may increase or decrease the relative volume of TRU or LLW for each waste site. The relative volume of TRU may be increased when higher concentrated TRU material is blended with LLW material, resulting in additional TRU waste. Conversely, the relative volume of TRU material may be decreased when it is blended with lower concentration LLW, resulting in additional LLW material. The volumes in Table 4-2 do not include non-waste material, such as overburden, that will be excavated.

Table 4-2. RTD of Contaminated Soil and Debris Waste Volumes

Waste Site	LLW Volume <5 nCi/g (m^3)	LLW Volume >5 nCi/g (m^3)	TRU Volume (m^3)	Roll-On/ Roll-Off (No. of Units)	2.7 × 1.5 × 1.5 m (9 × 5 × 5 ft) Boxes (No. of Units)	208 L (55 gal) Drum (No. of Units)	SLB2 Containers (No. of Units)
216-Z-1D/ UPR-200-W-110	69,000	1,400	200	9,800	220	1,000	0
216-Z-11	32,000	2,300	270	4,500	360	1,400	0
216-Z-19	40,000	90	8	5,700	20	40	0
216-Z-20	28,000	0	0	3,900	0	0	0
216-Z-5	2,300	6	40	320	1	32	9
216-Z-18	2,500	1,200	1,200	350	190	5,900	0
216-Z-12	25,000	1,100	1,100	3,500	170	5,200	0
216-Z-9	11,000	1,100	130	1,600	160	650	14
216-Z-1A	18,000	3,400	2,300	2,600	530	11,300	0
216-Z-1/ 216-Z-2	6,200	680	170	890	220	570	15
216-Z-3	18,000	680	190	2,500	220	940	6
200-W-174-PL	0	0	5	0	0	0	1
200-W-207-PL	0	130	0	0	20	0	0
200-W-208-PL	0	0	40	0	0	0	6
200-W-210-PL	0	0	18	0	0	0	3
200-W-206-PL	0	0	3	0	0	0	1
200-W-178-PL	0	0	9	0	0	0	2
Total	252,000	12,086	5,683	35,660	2,111	27,032	57

LLW = low-level waste
RTD = removal, treatment (as needed), and disposal
SLB2 = standard large box 2
TRU = transuranic

4.3.2.4 Requirements

Requirements for this task are established in the following laws, regulations, and DOE orders and standards:

- 10 CFR 71
- 10 CFR 835
- 10 CFR 851
- CRD for DOE M 460.2-1A
- CRD for DOE O 460.1C
- DOE/RL-2001-36
- DOE/WIPP-02-3122
- HNF-EP-0063
- WCH-191

A summary of the requirements that are applicable to this scope of work is in Appendix B.

4.3.2.5 Interfaces

Successful execution of activities within this task requires interface with various Hanford Site and non-Hanford Site organizations. The interfaces for this task are included in Table 4-3.

Table 4-3. RTD of Contaminated Soil and Debris Interfaces

Initiator	Receiver	Interface Description
Remediation Project	ERDF	LLW ready for disposal
Remediation Project	CHPRC Decommissioning, Waste, Fuels & Remediation Services	Certifiable TRU waste 218-W-4C Expansion Area
Remediation Project	DOE-RL/EPA	Verification sample results
Remove, Treat, and Dispose of Contaminated Soil and Debris	Enhance Soil Cover, Install ET Barriers, and Demobilize Project	Waste sites ready for ET barriers
Remove, Treat, and Dispose of Contaminated Soil and Debris	Long-Term Stewardship	Waste sites ready for long-term stewardship
Waste Services	Remediation Project	Waste services – includes transportation safety

CHPRC = CH2M HILL Plateau Remediation Company
DOE-RL = U.S. Department of Energy-Richland Operations
EPA = U.S. Environmental Protection Agency
ERDF = Environmental Restoration Disposal Facility
ET = evapotranspiration
LLW = low-level waste
RTD = removal, treatment (as needed), and disposal
TRU = transuranic

4.3.2.6 Completion Criteria

At the completion of this task, the following criteria will have been met:

- Contaminated soil and debris removed from 216-Z-1D, 216-Z-11, 216-Z-19, 216-Z-20, UPR-200-W-110, 216-Z-1A, 216-Z-1, 216-Z-2, 216-Z-3, 216-Z-5, 216-Z-9, 216-Z-12, and 216-Z-18
- LLW resulting from RTD of the contaminated soil and debris disposed at ERDF
- TRU waste resulting from RTD of the contaminated soil and debris staged at CWC pending certification and shipment to WIPP
- Results of verification sampling reviewed and accepted by DOE-RL and EPA
- The following waste sites backfilled and revegetated: 216-Z-1D, 216-Z-11, 216-Z-19, 216-Z-20, and UPR-200-W-110
- The following waste sites backfilled and waiting for installation of an ET barrier: 216-Z-1A, 216-Z-1, 216-Z-2, and 216-Z-3, 216-Z-5, 216-Z-9, 216-Z-12, and 216-Z-18
- Pipelines (200-W-174-PL, 200-W-178-PL, 200-W-206-PL, 200-W-207-PL, 200-W-208-PL, and 200-W-210-PL) removed to the project boundary and capped or blanked; excavated sites backfilled

4.3.3 Remove, Treat, and Dispose of the Settling Tanks

RTD of the settling tanks begins with preparing the tanks and continues through backfill and revegetation. The following sections describe the scope, deliverables, assumptions, requirements, interfaces, and completion criteria for this task.

4.3.3.1 Scope

RTD of settling tanks from the 200-PW-1 and 200-PW-6 OUs includes management and operations of the STRS after it is turned over for operations. RTD operations for the settling tanks will result in complete removal of the 241-Z-8 and 241-Z-361 Settling Tanks and their contents.

The scope for managing RTD of the settling tanks includes the following tasks:

- Manage the settling tank waste sites until start of long-term stewardship.
- Maintenance and ownership of the authorization bases documents (e.g., DSAs and air permits) required for O&M at the site during the period of management ownership.
- Review and approve project documentation developed during the period of management ownership that affects settling tank work sites (e.g., safety bases development and implementation and operating procedures).
- Provide technical staff for waste profiling and waste shipping.
- Acquire waste containers, as necessary, for RTD of the settling tanks.

As identified in the ROD (EPA et al., 2011), past investigation could not confirm the structural integrity of the bottom of the 241-Z-8 Settling Tank; therefore, due to the uncertain tank structural integrity, it was concluded that the potential for a substantial threat of release to the environment exists. Because of uncertainties in the integrity of the 241-Z-8 Settling Tank, which is depicted in Figure 4-11, and the level of contamination remaining within the tank, the existing tank contents will be stabilized (e.g., using grout or an alternative fixative) in place. The tank will be size reduced (e.g., cut into sections), and the tank sections, including stabilized contents, will be packaged for ultimate disposal at WIPP. The work will be performed within a contamination control structure under a weather enclosure that will later be relocated for use at the 216-Z-9 Trench. Specific activities for RTD of the 241-Z-8 Settling Tank include the following:

- Design the excavation.
- Perform supplemental surveying, clearing, grubbing, and grading required for the operation.
- Remove overburden and stockpile pending use for backfill or dust control.
- Place a weather enclosure over the excavation area.
- Excavate sufficiently to expose the entire tank and provide a working area for RTD of the tank.
- Disposition soil as TRU or LLW, based on assay. TRU waste will be packaged for disposal at WIPP; LLW will be packaged for disposal at ERDF.
- Install contamination control structure.
- Move equipment and supplies to appropriate work locations within and around the contamination control structure and weather enclosure for RTD of the tank.
- Partially fill the tank with grout (or alternative fixative) to immobilize contamination.
- Externally assay the tank to determine section sizes that can be disposed of within a standard large box 2 (SLB2) container; section the tank and size reduce sections sufficiently to place into the SLB2.
- Confirm that the SLB2s contain TRU waste.
- Prepare shipping documents.
- Ship SLB2s to CWC.
- Perform verification sampling of the 241-Z-8 excavation area per the SAP (DOE/RL-2015-22).
- Demobilize the STRS at the 241-Z-8 Settling Tank.
- Pending DOE-RL and EPA review and acceptance of verification sampling results, backfill and revegetate the 241-Z-8 excavation area.

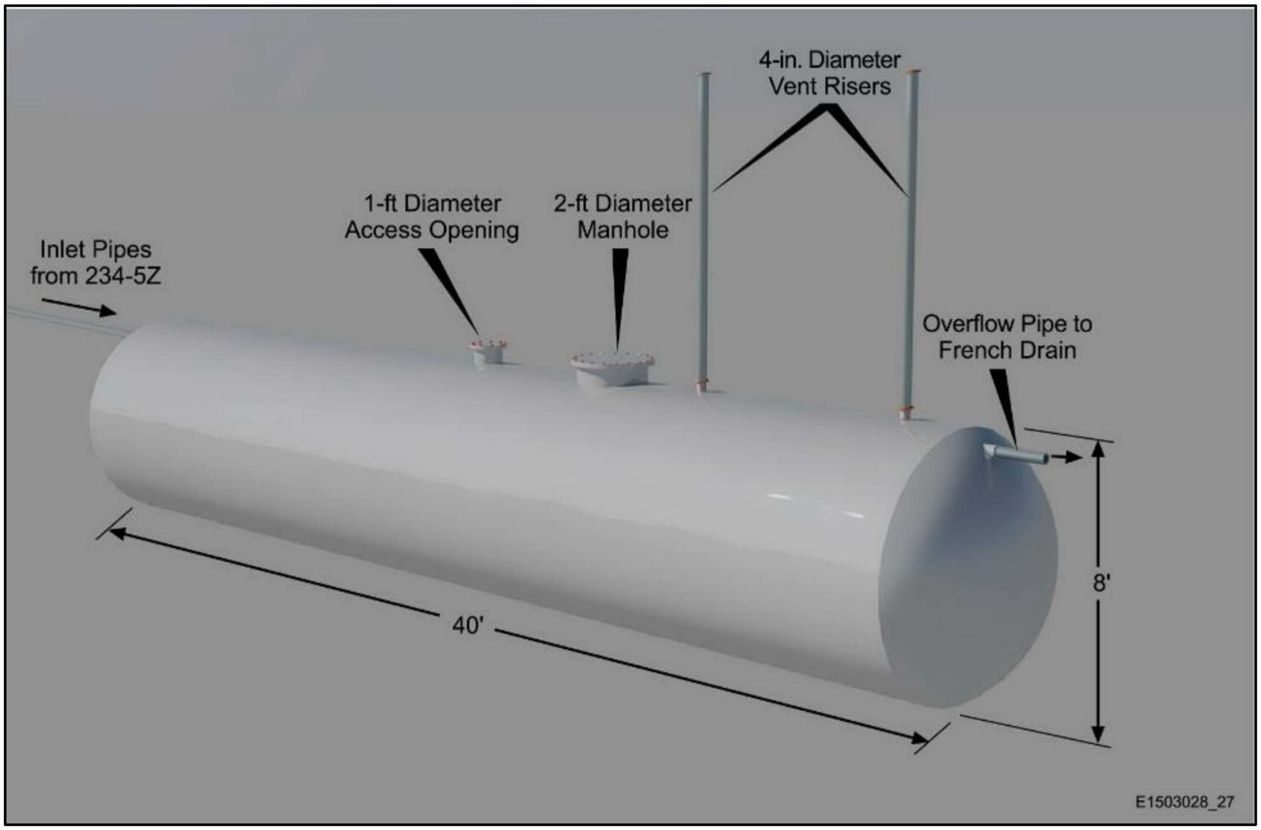

Figure 4-11. Schematic of 241-Z-8 Settling Tank

Because of the characteristics of the sludge material in the 241-Z-361 Settling Tank, as identified in HNF-8735, *241-Z-361 Tank Characterization Report*, and likely difficulty in attaining closure of the tank under the substantive portions of WAC 173-303-610(2), RTD of the tank will include total removal and disposal of the tank. Tank contents will be removed sufficiently to enable removal, packaging, and disposal of the tank and remaining contents at WIPP without later repackaging. The extent of required sludge removal will be determined during technology demonstration. If sludge must be removed from the tank prior to tank removal, the sludge will be stabilized (e.g., grouted) in a process enclosure attached to the tank. The process enclosure will be located inside a contamination control structure. The grouted sludge will be dried and assayed, size reduced (if necessary), and loaded into a waste package. The tank will then be size reduced within the contamination control structure. A depiction of the 241-Z-361 Settling Tank excavation and weather enclosure is provided in Figure 4-12. For efficiency, excavation of 241-Z-361 will be performed after excavation of the 241-Z-1A Tile Field, 241-Z-1 Crib, 241-Z-2 Crib, and 241-Z-3 Crib and prior to complete backfilling of those excavated sites. The relationship of these sites is depicted in Figure 4-5.

Specific activities for RTD of the 241-Z-361 Settling Tank, based on this approach, include the following:

- Design the excavation.
- Perform supplemental surveying, clearing, grubbing, and grading required for the operation.
- Remove overburden and stockpile pending use for backfill or dust control.
- Place a weather enclosure over the excavation area.

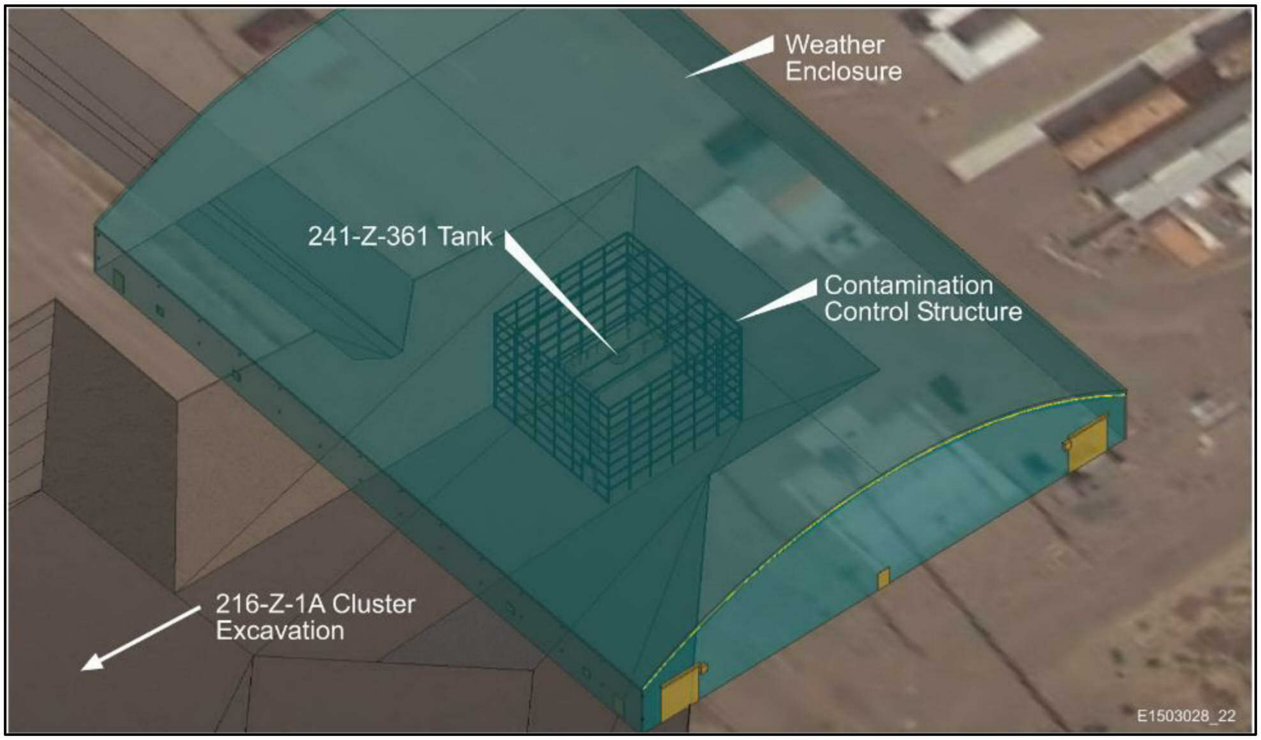

Figure 4-12. 241-Z-361 Settling Tank Excavation Area

- Excavate sufficiently to expose the tank as required to provide a working area for RTD of the tank (install pilings and lagging as required to ensure tank integrity is maintained).
- Disposition excavated soil as TRU or LLW, based on assay. TRU waste will be packaged for disposal at WIPP; LLW will be packaged for disposal at ERDF.
- Install the 241-Z-361 Settling Tank process enclosure on the exposed face of the tank.
- Install grouting and drying equipment and a container loading system.
- Install a ventilation system on the tank with an opening to provide ventilation exhaust from process enclosure through the tank to the exhaust skid.
- Install sludge removal equipment in the tank.
- Provide penetration into the tank, as necessary, to facilitate grout removal.
- Transfer sludge from the tank into the process enclosure using sludge removal equipment.
- Grout sludge, dry, assay, size reduce, and load into the 55 gal (208 L) drums for later disposal at WIPP.
- After removal of sufficient sludge from the tank to support packaging and treatment of the tank for WIPP acceptance, grout the bottom foot of the tank, and apply a fixative to the exposed inside walls of the tank for contamination control.
- Size reduce the process enclosure, equipment, and tank within the contamination control structure and load into SLB2 containers for later disposal at WIPP.

- Conduct final soil removal and verification sampling commensurate with the SAP (DOE/RL-2015-22).
- Confirm that SLB2s contain TRU waste.
- Prepare shipping documents.
- Ship SLB2s to CWC.
- Demobilize the STRS.
- Pending DOE-RL and EPA review and acceptance of verification sampling results, backfill and revegetate the 241-Z-361 excavation area.

Alternatively, if WIPP criteria can be satisfied and technology is demonstrated to be viable, cost effective, and safe during technology demonstration, the top of the tank will be removed, a stabilization material (e.g., grout) will be added and mixed with the sludge, and the tank size will be reduced and packaged for disposal at WIPP with the tank contents. This operation would be conducted within a contamination control structure.

4.3.3.2 Deliverables

The following deliverables are associated with this task:

- 241-Z-8 Settling Tank removed and properly disposed
- 241-Z-8 Settling Tank excavation area sampled and characterized per the SAP (DOE/RL-2015-22)
- Results of verification sampling reviewed and accepted by DOE-RL and EPA
- 241-Z-8 Settling Tank excavation area backfilled and revegetated
- 241-Z-361 Settling Tank removed and properly disposed
- 241-Z-361 Settling Tank excavation area sampled and characterized per the SAP (DOE/RL-2015-22)
- Results of verification sampling reviewed and accepted by DOE-RL and EPA
- 241-Z-361 Settling Tank excavation area backfilled and revegetated
- TRU waste from RTD of settling tanks staged at CWC pending certification and shipment to WIPP
- LLW from RTD of settling tanks disposed of at ERDF

4.3.3.3 Assumptions

Specific assumptions for this task are as follows:

- Waste treatment and packaging will be performed at the project site.
- Soil contaminated with between >5 and <80 nCi TRU/g will need to be packaged to meet ERDF waste acceptance criteria (WCH-191).
- Due to uncertainties in structural integrity, closure of the two settling tanks to meet the substantive requirements of tank closure in accordance with WAC 173-303-610(2), "Dangerous Waste Regulations," "Closure and Post-Closure," by demonstrating the extent of sludge removal, followed by stabilization of the tanks, is not technically viable.

- Use of large quantities of water for 241-Z-361 Settling Tank waste retrieval is not acceptable.
- Sludge will be removed to the extent necessary to facilitate tank removal and packaging for WIPP disposal.
- The settling tank waste (tank structure and sludge) will be TRU debris waste.
- Grout is an acceptable treatment for sludge to meet the WIPP waste acceptance criteria (DOE/WIPP-02-3122).
- Pipelines and other components that connect to a project waste site will be disconnected or blanked at the project boundary.
- Pending public involvement and a change to the ROD (EPA et al., 2011), a site-specific treatment variance will be implemented that will exempt the project from treating LLW waste prior to disposal at ERDF.
- LLW will be packaged to comply with the current (May 2015) ERDF waste acceptance criteria (WCH-191).
- TRU waste will be packaged to comply with the current (May 2015) WIPP waste acceptance criteria (DOE/WIPP-02-3122).

The estimated waste volumes and number of waste packages that will be generated during RTD of the settling tanks are listed in Table 4-4.

Table 4-4. RTD Settling Tanks Waste Volume

Settling Tank	LLW Volume <5 nCi/g (m^3)	TRU Volume (m^3)	Roll-On/ Roll-Off (No. of Units)	208 L (55 gal) Drums (No. of Units)	SLB2 Containers (No. of Units)
241-Z-8	170	65	25	0	34
241-Z-361	14,000	390	2,000	1,200	40
Total	14,170	455	2,025	1,200	74

LLW = low-level waste
RTD = removal, treatment (as needed), and disposal
SLB2 = standard large box 2
TRU = transuranic

4.3.3.4 Requirements

Requirements for this task are established in the following laws, regulations, and DOE orders and standards:

- 10 CFR 71
- 10 CFR 835
- 10 CFR 851
- CRD for DOE M 460.2-1A
- CRD for DOE O 460.1C
- DOE/RL-2001-36
- DOE/WIPP-02-3122

- HNF-EP-0063
- WCH-191

A summary of the requirements that are applicable to this scope of work is in Appendix B.

4.3.3.5 Interfaces

Successful execution of activities within this task requires interface with various Hanford Site and non-Hanford Site organizations. The interfaces for this task are included in Table 4-5.

Table 4-5. RTD Settling Tank Interfaces

Initiator	Receiver	Interface Description
Remediation Project	ERDF	LLW ready for disposal
Remediation Project	CWC	Certifiable TRU waste
Remediation Project	DOE-RL/EPA	Verification sample results
Remove, Treat, and Dispose of Settling Tanks	Long-term Stewardship	Waste sites ready for long-term stewardship
Waste Services	Remediation Project	Waste services – includes transportation safety

CWC = Central Waste Complex
DOE-RL = U.S. Department of Energy-Richland Operations Office
EPA = U.S. Environmental Protection Agency
ERDF = Environmental Restoration Disposal Facility
LLW = low-level waste
RTD = removal, treatment (as needed), and disposal
TRU = transuranic

4.3.3.6 Completion Criteria

At the completion of this task, the following criteria will have been met:

- 241-Z-8 Settling Tank removed and properly dispositioned
- 241-Z-8 Settling Tank waste site sampled per the SAP (DOE/RL-2015-22)
- 241-Z-8 Settling Tank waste site backfilled and revegetated after acceptance of sample results from DOE-RL and EPA
- 241-Z-361 Settling Tank removed and properly dispositioned
- 241-Z-361 Settling Tank waste site sampled per the SAP (DOE/RL-2015-22)
- 241-Z-361 Settling Tank waste site backfilled and revegetated after acceptance of sample results from DOE-RL and EPA
- LLW resulting from RTD of the settling tanks disposed of at ERDF
- TRU waste resulting from the RTD of the settling tanks stored at CWC pending certification and shipment to WIPP

4.3.4 Enhance Soil Cover, Install ET Barriers, and Demobilize Project

Enhance soil cover; install ET barriers for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs; and demobilize SRS and STRS begins with preparing to enhance soil cover and install ET barriers and continues through demobilization of the project. The following subsections describe the scope, deliverables, assumptions, requirements, interfaces, and completion criteria for this task.

4.3.4.1 Scope

Enhance soil cover; install ET barriers for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs; and demobilize SRS and STRS includes the following tasks:

- Manage activities to enhance soil cover and install ET barriers.
- Enhance soil cover, as necessary, for the Cesium-137 Waste Group.
- Install ET barriers for the 216-Z-1A, 216-Z-1, 216-Z-2, and 216-Z-3, 216-Z-5, 216-Z-9, 216-Z-12, and 216-Z-18 waste sites.
- Reinstall wells that need to be relocated.
- Demobilize the project.

The end state configurations for the 200 West Area waste sites and the cesium-137 waste sites are depicted in Figures 4-13 and 4-14, respectively.

4.3.4.2 Deliverables

Deliverables for this task are as follows:

- Enhanced soil covers in place for the following waste sites: 216-A-7, 216-A-8, 216-A-24, 216-A-31, and UPR-200-E-56
- ET barrier for the 216-Z-1A Tile Field, 216-Z-1 Crib, 216-Z-2 Crib, and 216-Z-3 Crib
- ET barrier for the 216-Z-5 Crib
- ET barrier for the 216-Z-9 Trench
- ET barrier for the 216-Z-12 Crib
- ET barrier for the 216-Z-18 Crib
- Demobilization of 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Remediation Project, including installation of active wells at new locations that were decommissioned during site mobilization

Figure 4-13. 200 West Area Sites at Completion

Figure 4-14. 200 East Area Waste Sites at Completion

4.3.4.3 Assumptions

Specific assumptions for this task are as follows:

- The alternative description for the Maintain/Enhance Soil Cover in the 200-PW-1, 200-PW-3, and 200-PW-6 OUs feasibility study (DOE/RL-2007-27, Section 6.3 [pages 6-7]) provides the basis for the amount of soil that is required to be added.
- ET barriers will cover the waste site footprint
- A single ET barrier will be installed over the 216-Z-1A Tile Field, 216-Z-1 Crib, 216-Z-2 Crib, and 216-Z-3 Crib
- The ET barrier design described in the 200-PW-1, 200-PW-3, and 200-PW-6 feasibility study (DOE/RL-2007-27, Figure 4.1) provides the basis for the ET barriers.
- Active groundwater monitoring wells will be relocated close to the original location, as determined by the groundwater monitoring scientists. A total of 87 wells will be relocated.

A representative configuration of an ET barrier is depicted in Figure 4-15. The dimensions and volumes of materials that will be used for the respective waste sites are listed in Tables 4-6 and 4-7, based on the configuration shown in Figure 4-15.

The alternative for maintaining and enhancing the existing soil cover in DOE/RL-2007-27 provides a minimum of 4.5 m (15 ft) of soil cover. For this alternative, approximately 0.3 m (1 ft) of fill will be constructed over two sites, 216-A-24 and 216-A-31, to grade the site for adequate drainage. The fill will also be used as topsoil for planting vegetation to stabilize the soil. For 216-A-7, 1.2 m (4 ft) of clean fill dirt will be added, and a final 0.3 m (1 ft) of topsoil will be placed over that. For 216-A-8, 1.4 m (4.5 ft) of fill dirt and 0.3 m (1 ft) of topsoil will be added. For UPR-200-E-56, 2 m (6.5 ft) of fill dirt and 0.3 m (1 ft) of topsoil will be added.

4.3.4.4 Requirements

Requirements for this task are established in the following laws, regulations, and DOE orders and standards: 10 CFR 835 and 10 CFR 851.

A summary of the requirements that are applicable to this scope of work is in Appendix B.

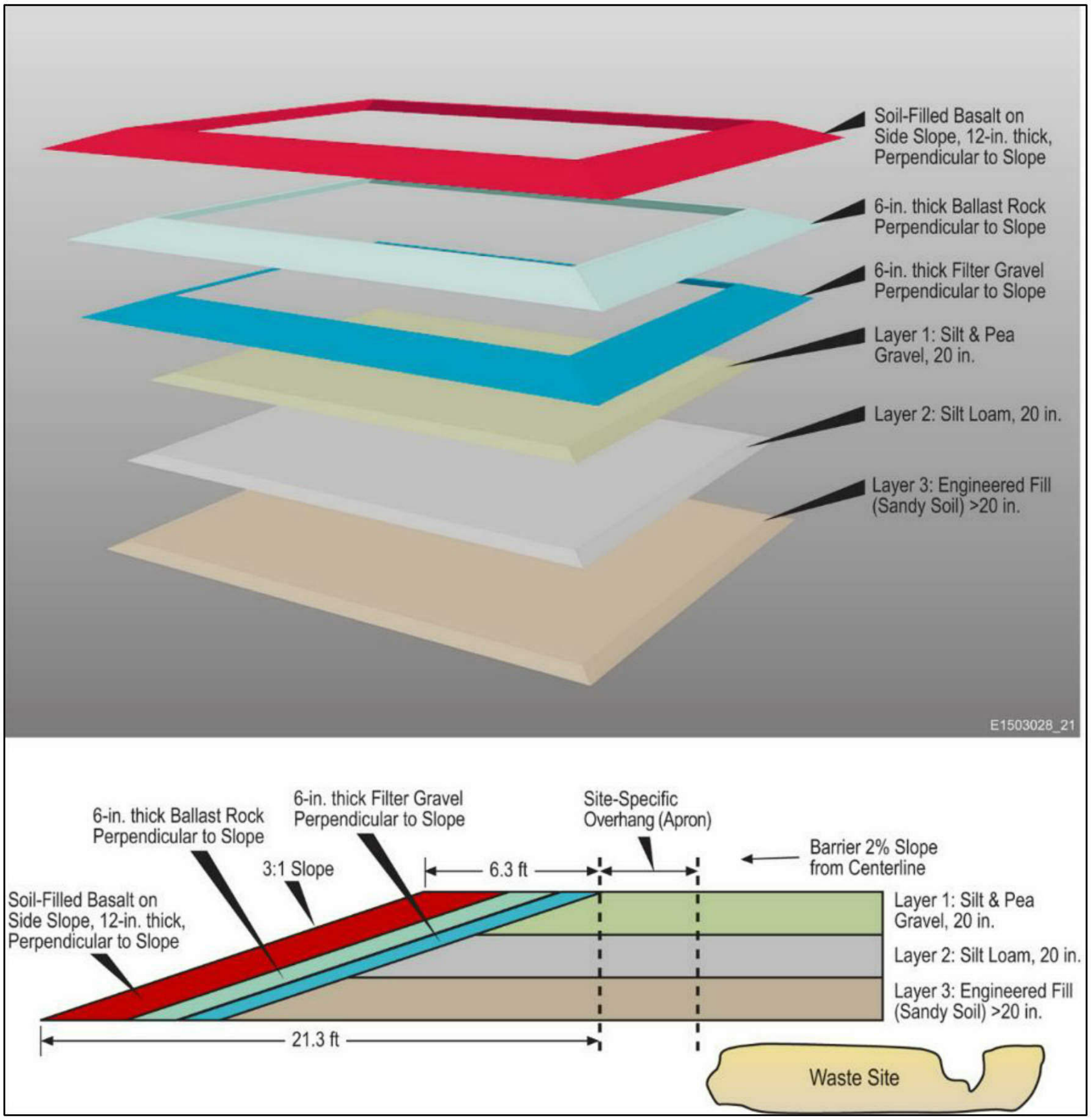

Figure 4-15. Three-Dimensional Model of the 216-Z-9 Trench ET Barrier

Table 4-6. ET Barrier Dimensions

Site	Site Type	Waste Group	Length (m)	Width (m)	Area (m^2)	Area (ha [ac])
216-Z-1 Cluster	Tile field/crib	High Salt	141	85	11,899	1.17 (2.9)
216-Z-9	Trench with roof	High Salt	51	41	2,097	0.2 (0.5)
216-Z-18	Crib	High Salt	105	122	12,826	1.29 (3.2)
216-Z-5	Crib	Low Salt	49	29	1,411	0.12 (0.3)
216-Z-12	Crib	Low Salt	127	41	5,234	0.53 (1.3)
					33,467	3.31 (8.2)

ET = evapotranspiration

Table 4-7. ET Barrier Volumes

Site	Layer 1: Silt and Pea Gravel (m^3)	Layer 2: Silt Loam (m^3)	Layer 3: Engineered Fill (Sandy Soil) (m^3)	Soil Filled Basalt on Side Slope (m^3)	Ballast Rock (m^3)	Filter Gravel (m^3)
216-Z-1 Cluster	4,800	5,118	5,446	627	309	306
216-Z-9	592	704	825	236	114	111
216-Z-18	5,261	5,582	5,912	632	312	309
216-Z-5	332	421	520	195	93	91
216-Z-12	1,528	1,839	2,168	448	220	217
Total	12,513	13,664	14,871	2,138	1,048	1,034

ET = evapotranspiration

4.3.4.5 Interfaces

Successful execution of activities within this task requires interface with various Hanford Site and non-Hanford Site organizations. The interfaces for this task are included in Table 4-8.

Table 4-8. Enhance Soil Cover, Install ET Barriers, and Demobilize Project Interfaces

Initiator	Receiver	Interface Description
Remediation Project	Long-Term Stewardship	Relocated groundwater monitoring wells Long-term monitoring of barriers
Remove, Treat, and Dispose of Contaminated Soil and Debris	Enhance Soil Cover, Install ET Barriers, and Demobilize Project	Waste sites ready for ET barriers

ET = evapotranspiration

4.3.4.6 Completion Criteria

At the completion of this task, the following criteria will have been met:

- Enhanced soil covers in place for the following waste sites: 216-A-7, 216-A-8, 216-A-24, 216-A-31, and UPR-200-E-56
- ET barrier installed for the 216-Z-1A Tile Field, 216-Z-1 Crib, 216-Z-2 Crib, and 216-Z-3 Crib
- ET barrier installed for the 216-Z-5 Crib
- ET barrier installed for the 216-Z-9 Trench
- ET barrier installed for the 216-Z-12 Crib
- ET barrier installed for the 216-Z-18 Crib
- Active wells prior to start of project mobilization replaced at new locations, as determined to be required by groundwater monitoring scientist
- Equipment demobilized (disposed of or returned to owner, if leased)
- Onsite facilities demobilized to a safe, stable configuration

4.3.5 Long-Term Stewardship

Long-term stewardship begins with completion of the RAs and continues for 1,000 years. The following sections describe the scope, deliverables, assumptions, requirements, interfaces, and completion criteria for this task.

4.3.5.1 Scope

This work package addresses long-term stewardship for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs and includes the following scope:

- Management of long-term stewardship
- ICs
- Surveillance and O&M (e.g., groundwater monitoring, barrier maintenance, enhanced soil cover maintenance)
- CERCLA 5-year review

4.3.5.2 Deliverables

Deliverables for this task are listed as follows:

- Maintenance of ET barriers

4.3.5.3 Assumptions

Specific assumptions for this task are listed as follows:

- ICs are described in ECF-Hanford-12-0067, *Institutional Controls Costs Apportioned by ROD Groups*.
- ET barriers will be replaced every 500 years, based on engineering judgment.

- SVE operations are complete.
- Remedial action and IC actions for this task include only the sites currently identified in the ROD (EPA et al, 2011).

4.3.5.4 Requirements

Requirements for this task are established in the following laws, regulations, and DOE orders and standards: 10 CFR 835 and 10 CFR 851.

A summary of the requirements that are applicable to this scope of work is in Appendix B.

4.3.5.5 Interfaces

Successful execution of activities within this task requires interface with various Hanford Site and non-Hanford Site organizations. The interfaces for this task are included in Table 4-9.

Table 4-9. Long-Term Stewardship Interfaces

Initiator	Receiver	Interface Description
Remediation Project	Long-Term Stewardship	Remediated 200-CW-5 OU
Remediation Project	Long-Term Stewardship	Remediated 200-PW-1 OU
Remediation Project	Long-Term Stewardship	Remediated 200-PW-3 OU
Remediation Project	Long-Term Stewardship	Remediated 200-PW-6 OU

OU = operable unit

4.3.5.6 Completion Criteria

Upon completion of this task, ICs will be in place for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs.

This page intentionally left blank.

5 Environmental Management and Controls

Chapter 5 describes the management and controls for air emissions, waste, cultural and ecological resources, safety and health, emergency response, and QA needed to implement the remedial design described in Chapter 3 and the tasks described in Chapter 4.

5.1 Air Emissions

Federal and state ambient air quality standards require that pollution control equipment be used to control emissions from new and existing sources. Remediation of the 200-CW-5, 200-PW-1, and 200-PW-6 OUs creates the potential to discharge hazardous air pollutants. Ventilation systems used to control and manage air emissions will be required to meet the applicable ARARs for radioactive and nonradioactive constituents.

The RA has the potential to release a variety of radioactive and chemical contaminants to the ambient air. The following sections describe the management of these emissions to ensure that they are ALARA and appropriately monitored.

5.1.1 Radiological Air Emissions

Federal regulations found in 40 CFR 61, "National Emission Standards for Hazardous Air Pollutants," Subpart H, "National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities," require that emissions of radionuclides to the ambient air shall not exceed amounts that would cause any member of the public to receive an effective dose equivalent of 10 mrem/yr. The substantive requirements for monitoring of point source (e.g., containment structures and tanks) and fugitive or nonpoint sources emitting radioactive airborne emissions (WAC 246-247-075(8), "Radiation Protection—Air Emissions," "Monitoring, Testing and Quality Assurance") will be addressed by sampling the effluent streams and/or ambient air as appropriate using reasonable and effective methods.

The state implementing regulations require added ALARA based controls of radioactive airborne emissions to the extent economically and technologically feasible (WAC 246-247-040(3) and (4), "General Standards," and associated definitions) that could be reasonably expected to reduce emissions. In order to address the substantive aspect of these requirements, best available controls consistent with ARAR requirements (WAC 246-247-040(3)) will be used when economically and technologically feasible based on the methodology of evaluation of process variables, applicable technologies, feasibility, and effectiveness and practicality from an environmental, energy, and economic impact consideration.

RCW 70.94, "Washington Clean Air Act," requires regulation of radioactive air pollutants. WAC 173-480, "Ambient Air Quality Standards and Emission Limits for Radionuclides," sets standards that are as or more stringent than the federal *Clean Air Act of 1990* and under the federal implementing regulation (40 CFR 61, Subpart H).

5.1.1.1 Airborne Source Information

Handling radiologically contaminated materials during the 200-CW-5, 200-PW-1, and 200-PW-6 OU RA has the potential to generate particulate emissions from point sources and diffuse or fugitive sources. No radiologically contaminated material will be disturbed during the 200-PW-3 OU activities that involve the addition of soil above the contaminated material. The annual unabated PTE and resultant effective dose calculations for the maximally exposed individual (MEI) are based on estimated holdup in the structures and the dose-per-unit-release factors from DOE/RL-2006-29, *Calculating Potential-to-Emit Radiological Releases and Doses*, which designates the assigned MEI for the Hanford Site emissions zone. For the 200-CW-5, 200-PW-1, and 200-PW-6 OUs in the 200 West Area, the assigned onsite MEI is at the Laser Interferometer Gravitational Wave Observatory (LIGO). This location represents the nearest unrestricted public access and, therefore, the MEI for assessing the potential public exposure due to airborne releases. LIGO is on the Hanford Site and requires use of the onsite MEI dose-per-unit-release factors. No PTE was estimated for the 200-PW-3 OU work because no radiologically contaminated material is available for release to the atmosphere.

In the absence of a unified data set obtained from site sampling, data from previous characterization efforts were examined. The data came from multiple sources of information and involved multiple methods used to estimate radiological contamination contained in the 200-CW-5, 200-PW-1, and 200-PW-6 OU structures. A hierarchy was established to determine what data would be used to calculate the PTE where multiple types of information were available for an individual structure. This approach was used to avoid either underestimating or overestimating the material available for release to the atmosphere to provide a reasonable basis for estimating potential human health effects as well as the cost of remediation. The data hierarchy used in order of preference is as follows:

- Average soil concentration from data (DOE/RL 2003-11)
- Mass contributed using mass balances (HNF-8735; WHC-EP-0674, *Groundwater Impact Assessment Report for the 216-Z-20 Crib, 200 West Area*; DOE/RL-2007-27)
- Mass contributed by liquid discharges (HNF-1744, *Radionuclide Inventories of Liquid Waste Disposal Sites on the Hanford Site*)
- Maximum soil concentration from data contained in the ROD (EPA et al., 2011)

The volumes of material (uncontaminated overburden and contaminated soil and debris) were estimated using the sizes of the structures and depths of contamination bounded by the maximum cleanup depth provided in the ROD (EPA et al., 2011). Where soil concentrations were used, these volumes were applied to each soil concentration radionuclide activity and then totaled to determine the total estimated activity for each crib, ditch, or tank. Where a radionuclide mass was used, this value was used to calculate the activity for each radionuclide and then the activities were totaled to provide the total estimated activity.

The identified radionuclides of concern for air emissions include antimony-125, americium-241, carbon-14, cerium-139, cesium-134, cesium-137, cobalt-60, europium-152, europium-154, europium-155, neptunium-237, nickel-63, potassium-40, plutonium-238, plutonium-239, plutonium-240, radium-226, radium-228, strontium-90, thorium-228, thorium-230, thorium-232, uranium-233, uranium-234, uranium-235, and uranium-238. Other radionuclides may be encountered during RA activities but are not anticipated at this time in other than negligible quantities.

Point source emissions are primarily associated with portable or temporary radioactive air emission units. Aggressive decontamination activities, such as scabbling, may be employed to reduce residual contamination. Emissions associated with aggressive decontamination will be discharged via a temporary enclosure equipped with a portable/temporary exhauster. These temporary units would discharge at elevations below 40 m (131 ft). Descriptions of any temporary emissions units (including proposed monitoring methods) used to exhaust directly to the atmosphere will be included as addendums to this RD/RAWP as information becomes available. Approval of addendums will be accomplished through the TPA (Ecology et al., 1989a) change process or by project manager meeting notes as decided between the lead agency (DOE) and the lead regulatory agency (EPA).

The activities described in this RD/RAWP will be conducted over several years. However, the unabated PTE estimates conservatively assume that the activities are all conducted within 1 year. Actual emissions will be less than the PTE estimates due to the use of various abatement technologies such as amended water, Soil-Sement® type products, and portable enclosure structures (unfiltered and HEPA filtered).

The unabated PTE estimate for the 216-Z-1D North Ditch is shown in Table 5-1. The maximum soil concentrations found in the 216-Z-1D North Ditch fall below the ROD (EPA et al., 2011) established cleanup levels and will require verification and evaluation to determine if the soil will require removal as part of the remediation.

Table 5-1. Potential Releases and Maximally Exposed Individual Doses Associated with the 216-Z-1D North Ditch

COC	Soil Maximum (pCi/g)	Activity (Ci)	TEDE to MEI (mrem/yr)
Plutonium-239/Plutonium-240	7.00E+01	8.10E-02	4.83E-04
Americium-241	1.00E+02	1.22E-01	5.75E-04
Cesium-137	Unknown	Unknown	Unknown
Radium-226	Unknown	Unknown	Unknown
Strontium-90	Unknown	Unknown	Unknown
			Total = 1.06E-03

COC = contaminant of concern
MEI = maximally exposed individual
TEDE = total effective dose equivalent

Unabated PTE tables (Tables 5-2 through 5-5) are presented for each of the major remediation areas (200-CW-5, 200-PW-1, and 200-PW-6 OUs; and the settling tanks). The combination of these tables provides a bounding unabated PTE for all remediation activities.

Table 5-2. Potential Releases and Maximally Exposed Individual Doses Associated with the 200-CW-5 OU

Location	Media/Type	Activity (Ci/yr)	TEDE to MEI (mrem/yr)
216-Z-1D South Ditch	Soil/Average	4.84E-01	8.11E-01
216-Z-11 Ditch	Soil/Average	7.77E-04	2.61E-03
216-Z-19 Ditch	Soil/Average	1.81E-01	8.54E-01
216-Z-20 Tile Field	Mass/Balance	2.82E-03	1.52E-02
UPR-200-W-110	Soil/Average	9.59E-03	4.36E-02
			Total = 1.73E+00

MEI = maximally exposed individual
OU = operable unit
TEDE = total effective dose equivalent

® Soil-Sement is a registered trademark of Midwest Industrial Supply, Inc., Canton, Ohio.

Table 5-3. Potential Releases and Maximally Exposed Individual Doses Associated with the 200-PW-1 OU

Location	Media/Type	Activity (Ci/yr)	TEDE to MEI (mrem/yr)
216-Z-1A Tile Field	Mass/Balance	9.72E+01	6.77E+01
216-Z-9 Crib	Mass/Balance	1.43E+01	2.22E+01
216-Z-18 Crib	Mass/Balance	3.92E+01	2.73E+01
216-Z-1 Crib	Mass/Balance	5.97E+00	4.16E+00
216-Z-2 Crib	Mass/Balance	5.97E+00	4.16E+00
216-Z-3 Crib	Mass/Balance	9.72E+00	6.77E+00
216-Z-12 Crib	Mass/Balance	3.67E+01	2.55E+01
			Total = 1.58E+02

MEI = maximally exposed individual
OU = operable unit
TEDE = total effective dose equivalent

Table 5-4. Potential Releases and Maximally Exposed Individual Doses Associated with the 200-PW-6 OU

Location	Media/Type	Activity (Ci/yr)	TEDE to MEI (mrem/yr)
216-Z-5 Crib	Mass/Balance	5.80E-01	4.04E-01
216-Z-8 French Drain	Mass/Balance	8.22E-02	5.37E-02
216-Z-10 Injection Well	Mass/Balance	8.52E-02	5.94E-02
			Total = 5.21E-01

MEI = maximally exposed individual
OU = operable unit
TEDE = total effective dose equivalent

Table 5-5. Potential Releases and Maximally Exposed Individual Doses Associated with the 241-Z-8 and 241-Z-361 Settling Tanks

Location	Media/Type	Activity (Ci/yr)	TEDE to MEI (mrem/yr)
241-Z-361 Tank	Mass/Balance	1.28E+02	8.91E+00
241-Z-8 Tank	Mass/Balance	2.56E+00	1.78E+00
			Total = 1.07E+01

MEI = maximally exposed individual
TEDE = total effective dose equivalent

The total conservative calculated potential (unabated) effective dose equivalent to the MEI resulting from the remediation activities is 170.9 mrem/yr.

Open-air excavation activities and the resulting potential for emissions are included in the preceding estimate. Aggressive decontamination activities, such as scabbling, may be employed to reduce residual contamination on structures (cribs and tanks) and would be subject to process-related, HEPA-filtered abatement. Activities will be conducted in conjunction with sound radiological practices to avoid unacceptable onsite consequences for the collocated worker and keep emissions ALARA. The work is controlled by radiological work permits (RWPs) that direct worksite monitoring and prescribe action levels as well as void limits specific to the work being performed. The action levels and void limits are established to maintain contamination spread, airborne radioactivity generation, and individual doses from radiological hazards ALARA or within regulatory or contractual limits. Real-time monitoring and surveys are used to evaluate compliance with the action levels and void limits; work is stopped, evaluated, and adjusted when the values established in the RWP are approached. This also ensures emissions will not cause the Hanford Site emissions to exceed the 40 CFR 61.92, "National Emission Standards for Hazardous Air Pollutants," of 10 mrem/yr to any member of the public (i.e., MEI). As part of the RA, potential diffuse and fugitive emissions will be continually evaluated to ensure that emission control techniques are being used effectively.

5.1.1.2 Airborne Emission Controls

Based on analysis of the potential emissions and evaluation of available control technologies, the following active controls of diffuse and fugitive emissions have been selected for use when practicable during the removal action. The radiological control and environmental organizations are responsible for selecting and ensuring that appropriate controls are implemented to maintain both worker exposure and environmental releases ALARA:

- Water in mists or fine sprays will be applied, as practicable, for suppression of fugitive emissions and dust during any excavation, backfilling, and demolition activities when contamination is present.
- Radiological surveys (e.g., swipes/smears) will be taken of demolition equipment leaving any areas where there is the potential for removable contamination above 2,000 dpm/100 cm^2 alpha following any demolition action. During deactivation activities, equipment, tools, and materials with removable contamination above 100,000 dpm/100 cm^2 beta/gamma or 2,000 dpm/100 cm^2 alpha will be decontaminated or wrapped, or the contamination will be otherwise fixed by an appropriate means before being removed from a structure.
- Appropriate controls such as water, fixatives, covers, containment tents, windscreens, or other controls during cessation of work activities will be applied, to the extent practicable, based on conditions in the work environment (i.e., weather conditions and predicted wind speeds greater than 32 km/hr [20 mi/hr]).
- Fixatives or cover material (e.g., soil, gravel, and plastic) will be applied to disturbed contaminated soils and debris at any time when field activities will be inactive for more than 24 hours. Additionally, if the sustained wind speed is predicted to be greater than 32 km/hr (20 mi/hr) overnight, based on the Hanford Meteorological Station forecast, fixative or cover material will be applied, as practicable.
- TRU waste containers will remain closed, except during packaging and waste inspection activities.
- Any vacuum cleaners and portable exhausters used for remediation activities will be equipped with appropriately tested HEPA-type filters. The following additional controls have been selected and could be implemented, as practicable, to minimize diffuse and fugitive emissions further:

   - Temporary contamination control structures may be used, as practicable, with or without active portable HEPA-type filtered exhauster(s) during portions of the remediation activities to minimize worker exposure. The term HEPA-type is intended to reflect nonstandard application of HEPA abatement not meeting engineered specifications (ASME AG-1-2012) of the applicable standards.

5.1.1.3 Airborne Emission Monitoring

The quantification of radioactive air emissions and air monitoring has been identified as requirements for remediation activities. Two components are associated with airborne emissions monitoring: point source monitoring (e.g., HEPA-filtered vacuums, portable HEPA-filtered exhausters, and temporary exhausters), and diffuse and fugitive monitoring (e.g., temporary ambient air monitors, near-facility monitors, and radiological surveys). During remediation activities, both components (point sources and diffuse and fugitive sources) will be monitored at the same time. Monitoring activities may include the following:

- Real-time and periodic radiological monitoring uses temporary ambient air monitors, as prescribed by the Radiological Control organization (primary method for evaluating compliance with the action levels and void limits) with concurrence from the Environmental organization.
- Radiological smear surveys; indicator – effluent air emission estimated rates are based on gross residual contamination levels.
- Near-facility ambient air monitoring will be performed at several locations around the remediation area.
- HEPA-filtered vacuums intended for use will vary in size and primarily will be small and portable, similar to the type in use on the Hanford Site, with flow capacities between 1.4 and 8.5 m^3/min (50 and 300 ft^3/min). Larger capacity units with flow rates of 56.6 m^3/min (2,000 ft^3/min) or higher could be used. These units will be used to manage localized airborne contamination as well as the removal of contaminated soil and debris generated from excavations associated with remediation activities. To verify low emissions periodically, a contamination survey of the outlet of the vacuum will be performed at the completion of use. Vacuuming using one of these devices has no specific contamination limit but will be controlled based on the specifics of the situation to ensure that the PTE from each unit does not exceed the minor source criterion. If contamination levels over 2,000 dpm alpha/100 cm^2 (i.e., high surface contamination area) are inadvertently exceeded, a separate evaluation regarding emissions measurement will be conducted. Portable HEPA-type filtered vacuums, portable HEPA-type filtered exhausters, and various types of containments will be used, as needed. A distinction between portable HEPA-type filtered exhausters and temporary HEPA-filtered exhausters is intended. Portable exhausters are minor emission units that are easily set up for use and readily portable, being either hand carried or wheel mounted. Due to the nature of the activities involving use of the HEPA-type filtered air movers, measurable abated release associated with these devices is not anticipated, and the near-facility monitoring stations described as follows will be used to assess air emissions for the activities associated with these portable point sources.

When excavation activities begin, worksite air monitoring will be the primary indicator of effectiveness of abatement and ALARA control methods during demolition activities. Worksite monitoring includes using temporary ambient air monitors (real-time continuous air monitors with alarms, personnel samplers, and ambient air samplers) and surveys. The worksite monitoring network will be established, as directed by the Radiological Control organization with concurrence from the Environmental organization, and will be focused around and in the established excavation zones. This monitoring network provides the primary emissions data used to ensure that limits set in the RWP are not exceeded. At a minimum, three (one upwind and two downwind) real-time alpha continuous air monitors with alarms will be located at each demolition zone boundary.

In addition to point source monitoring and worksite monitoring, the 200 West Area Near Facility Ambient Air Program stations surrounding the work area provide a secondary layer of monitoring. These six stations (N433, N554, N975, N165, N155, and N555) do not provide real-time data, so their data will be used as indicators along with the worksite monitoring data for overall trending of potential diffuse and fugitive emissions. During periods of active remediation activities, no more than one of these six monitors will be allowed to be inoperative for more than 24 hours.

Hanford Site perimeter monitoring provides the last layer of monitoring and is used to measure the diffuse and fugitive emissions from the Hanford Site. The well-established Hanford Site protocol for emission monitoring will be followed, including Hanford Site perimeter ambient air data collection, sampling frequencies, sample analysis, and data reporting (DOE/RL-91-50, *Hanford Site Environmental Monitoring Plan*). This method will address the substantive requirements of WAC 246-247-075. Demonstration of compliance with the 40 CFR 61.92 effective dose equivalent of 10 mrem/yr limit is provided by the annual radioactive air emissions report for the Hanford Site.

5.1.1.4 Nonradiological Air Emissions

The primary source of emissions resulting from this removal action will be fugitive particulate matter (criteria pollutants particulate matter (PM) less than 2.5 μm in diameter [PM2.5] and particulate matter less than 10 μm in diameter [PM10]). In accordance with WAC 173-400-040(3) and (8), "General Regulations for Air Pollution Sources," "General Standards for Maximum Emissions," reasonable precautions will be taken to prevent the release of air contaminants associated with fugitive emissions resulting from demolition, materials handling, or other operations and fugitive dust from becoming airborne from fugitive sources of emissions. Toxic air pollutants (TAPs) are not believed to be a concern based on the previous use of an SVE system.

5.1.1.5 Criteria Pollutants

Operation of trucks and other diesel-powered equipment during these removal activities would be expected, in the short term, to introduce quantities of sulfur dioxide, nitrogen dioxide, particulates, and other pollutants to the atmosphere, typical of similar-sized construction projects. These releases would not be expected to cause any air quality standards to be exceeded. Dust generated during removal activities would be minimized by watering or other dust control measures (e.g., use of fixatives). Vehicular and equipment emissions will be controlled and mitigated in compliance with the substantive standards for air quality protection that apply to the Hanford Site. These techniques are considered reasonable precautions to control fugitive emissions as required by the substantive requirements.

5.1.1.6 Toxic Air Pollutants

The available data with regards to soil concentrations of TAPs listed in WAC 173-460-150, "Controls for New Sources of Toxic Air Pollutants," "Table of ASIL, SQER and de Minimis Emission Values," are sparse. The anticipated chemicals of interest are carbon tetrachloride and methylene chloride based on the process knowledge associated with PFP activities. Previous use of SVE is believed to have removed sufficient quantities of volatile and toxic chemicals from the soil, so soil concentrations will be below de minimis levels listed in WAC 173-460-150. Additional data must be obtained, so that a demonstration of compliance with the ARARs of WAC 173-400 and WAC 173-460 can be made using an acceptable source impact analysis. The analysis will demonstrate that, after application of best available control technology for TAPs, the new source's maximum incremental ambient air impact levels do not exceed the WAC 173-460 Class A or Class B acceptable source impact levels. Otherwise, if applicable, the new source TAP emission rates do not exceed the small-quantity emission rates specified in WAC 173-460.

5.2 Reporting Requirements for Nonroutine Releases

Existing occurrence reporting requirements trigger timely notification to DOE and the lead regulatory agency (EPA) in case of a nonroutine release to the environment.

5.3 Waste Management

Waste generated from sampling activities will be managed in accordance with an approved waste control plan. The waste control plan establishes the requirements for management and disposal of generated waste. Waste management strategies for targeted waste retrieval address storage and disposition of anticipated waste streams. Information on the projected waste streams by the RA and requirements for waste identification, designation, management, and disposal are provided in the following subsections.

5.3.1 Projected Waste Streams

Table 5-6 contains the projected volume of waste to be generated by this RA.

Table 5-6. General Waste Stream Description

General Waste Stream Description	Hazard Classification Anticipated	Container Options	Estimated Total Volumes	Disposal Pathway Options	Hazard Source
Excavated soil and debris	Low-level mixed <5 nCi TRU/g	ERDF cans	~260,000 m^3	ERDF	CERCLA
Excavated soil and debris	Low-level mixed >5 nCi TRU/g	Burial boxes	~12,000 m^3	ERDF	CERCLA
Excavated soil and debris	TRU mixed	Drums, SWBs, or SLB2s	~6,000 m^3	CWC, ultimately to WIPP	CERCLA

CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CWC = Central Waste Complex
ERDF = Environmental Restoration Disposal Facility
SLB2 = standard large box 2
SWB = standard waste box
TRU = transuranic
WIPP = Waste Isolation Pilot Plant

5.3.2 Waste Characterization, Designation, and Disposal

This project will provide radioassay capability to guide waste packaging and disposal. Existing characterization data will be used, to the extent possible, for designating the hazardous components of the waste. A means (e.g., real-time radiography and visual examination) of ensuring the absence of noncompliant items within the waste matrix will be provided.

5.3.3 Waste Generation Management

Remediation of the 200-CW-5, 200-PW-1, and 200-PW-6 OUs will result in a significant amount of contaminated soil, sludge, and debris that will be managed and disposed of in compliance with the approved waste management procedures and the waste acceptance criteria for ERDF (WCH-191), CWC (HNF-EP-0063), and WIPP (DOE/WIPP-02-3122), as appropriate.

5.3.4 Management of Waste Containers

As the solid waste is generated, it will be packaged into appropriate containers, weighed, surveyed, characterized, labeled, and placed in a staging area pending shipment to either ERDF or CWC. The waste staging area will be defined during the design and acquisition of the remediation system. Waste containers will be tracked in the Solid Waste Information Tracking System, as prescribed by procedures. Due to the quantity of plutonium expected to be in the waste containers, the material accountability requirements will be addressed as appropriate.

5.3.5 Final Disposal/Storage

Waste that is determined to be low level or mixed low level will be treated (if necessary) and packaged for disposal at ERDF. LLW that contains greater than 5 nCi/g of TRU radionuclides will be packaged into waste boxes (assumed to be 2.7 by 1.5 by 1.5 m [9 by 5 by 5 ft]) then shipped to ERDF. LLW that contains less than 5 nCi/g will be placed into roll-on/roll-off boxes and shipped to ERDF.

Waste that is determined to be TRU or TRU mixed will be treated (if necessary) and packaged for interim storage at CWC, pending eventual certification, shipment, and disposal at WIPP. Due to the weight of the soil, it is assumed that most of the TRU waste will be packaged into 208 L (55 gal) drums. TRU debris resulting from removal of the pipelines will be size reduced and packaged into standard large box 2 (SLB2s). Sludge removed from the 241-Z-361 Settling Tank will be treated (e.g., grouted) and packaged into either 208 L (55 gal) drums or standard waste box (SWBs).

5.3.6 Waste Disposal Records

Waste management records will be created and managed in accordance with the approved waste management procedures.

5.3.7 Waste Transportation

Waste will be transported and shipped in accordance with the approved waste transportation procedures. The primary destinations for the waste generated as part of this RA will be ERDF for LLW and CWC for TRU waste.

5.3.8 Waste Treatment

Waste generated from the RA will be mostly contaminated soil with minor debris materials. If needed, the waste will be treated prior to disposal to meet 40 CFR 268, "Land Disposal Restrictions," or WIPP waste acceptance criteria (DOE/WIPP-02-3122). It is assumed that a 40 CFR 268.44, "Variance from a Treatment Standard," site-specific treatment standard variance will be obtained for the large quantity of contaminated soil excavated with relatively low concentrations of hazardous constituents, where EPA generally considers treatment standards based on combustion inappropriate. The process to obtain a treatability variance would require public involvement and a revision to the ROD (EPA et al., 2011).

5.3.9 Waste Minimization and Recycling

The overburden that will be removed as part of this RA will be used as backfill and bedding for contamination control to the extent practical. There will probably be opportunities to minimize waste generation by use of shoring to reduce the side slopes and careful, targeted removal of the TRU radionuclides. This will be explored during the design and acquisition of the remediation system.

5.4 Cultural/Ecological Resources

A cultural resources review under the *National Historic Preservation Act of 1966* and an ecological resources review in accordance with DOE/RL-95-11, *Ecological Compliance Assessment Management Plan*, are part of work planning activities. The project will involve cultural and ecological resources staff early in the planning stage to address/verify potential concerns and consider actions required to mitigate the effects that the planned project activities could have.

5.5 Safety and Health Program

The remediation contractor's hazardous waste health and safety program was developed for employees involved in hazardous waste site activities. The program was developed to comply with the requirements of 10 CFR 851, which incorporates the safety standards of 29 CFR 1910.120, "Occupational Safety and Health Standards," "Hazardous Waste Operations and Emergency Response," and 10 CFR 835 to ensure the safety and health of workers during operations involving potential exposure to hazardous and radioactive materials.

Some aspects of the RA are similar to tasks performed for soil remediation. Others are similar to tasks performed inside PFP or in the TRU Waste Retrieval Project. A review will be performed of PFP, the Soil and Groundwater Remediation Project, and TRU Retrieval Project HASPs; consequently, a remediation-specific plan may be developed, so that the hazards are addressed comprehensively.

A HASP (SGW-41472, *Soil and Groundwater Remediation Project Site-Specific Health and Safety Plan (HASP)*) was developed in accordance with the overall remediation contractor's health and safety program to define chemical, radiological, and physical hazards and specify the controls and requirements for day-to-day work activities overall on the Hanford Site. It also incorporates applicable core functions and guiding principles outlined in the ISMS and governs minimum personnel training, control of industrial safety and radiological hazards, PPE, site control, and general emergency response to spills, fire, accidents, injury, and incident reporting. This HASP (SGW-41472) identifies mitigative controls for general hazards that can be encountered within the project. Mitigative controls for task-specific hazards are identified and evaluated in task-specific job hazard analyses as part of the work package development process.

HASPs are not stand-alone documents; they are supplemented by other procedures governing work control, conduct of operations, industrial safety, maintenance, and waste handling. An industrial hygiene exposure assessment will be completed and followed for construction, startup, and remediation operations, as part of the hazards analysis process.

Regarding construction of the work elements associated with the RA (e.g., structural supports, ventilation, retrieval systems, stabilization equipment, and piping and pipe racks), the HASP will draw on the processes and procedures that were used for previous construction projects.

Any subcontractor used for portions of the work will also have safety submittal documents that become an integral part of the site safety expectations. The construction contractor's job safety/hazard analyses will address the health and safety hazards during each phase of construction project. The HASP will address operations required to complete the remediation steps.

Access and work activities will be controlled in accordance with approved work packages, as required by established internal work requirements and processes. The health and safety program addresses the health and safety hazards of each phase of site operation and includes the requirements for hazardous waste operations and/or construction activities, as specified in 29 CFR 1910.120.

Project field staff will be required to comply with all aspects of HASPs, work packages, work instructions, and procedures at all times during construction and operation of the equipment. Unescorted site visitors will be required to read and sign the HASP before entering the construction area and must have completed required training. Escorted visitors will be briefed on health and safety aspects of the work being observed and will be escorted by the site superintendent (or designee) at all times when they are in the construction area.

5.6 Emergency Response

During construction and operations, emergency response for project activities will be covered by the health and safety program. The health and safety program specifies primary emergency response actions for site personnel, area alarms, implementation of the emergency action plan and emergency equipment at the task site, emergency coordinators, emergency response, and spill containment.

5.7 Quality Assurance Program

Overall QA for implementing the RD/RAWP will be planned and implemented in accordance with 10 CFR 830, "Nuclear Safety Management," Subpart A, "Quality Assurance Requirements;" EPA/240/B-01/003, *EPA Requirements for Quality Assurance Project Plans* (EPA QA/R-5); and SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update IV-B*.

Designers are responsible for providing professional quality work that meets professional standards of care, skill, and diligence. Careful attention to quality requirements ensures that work is defensible, consistent between designers, and reproducible, including both the design and the associated documentation. A focused QA culture prevents expensive and time-consuming rework and establishes a method for obtaining a safe and effective facility startup.

QA activities will use a graded approach based on potential impacts to the environment, safety, health, reliability, and continuity of operations. QA for design will be addressed in a QA plan that describes the graded approach, beginning with currently acceptable standards as described in DOE O 414.1D, *Quality Assurance*, such as ASME NQA-1, 2008 *Quality Assurance Requirements for Nuclear Facility Applications*, with the ASME NQA-1A-2009, *Addenda to Quality Assurance Requirements for Nuclear Facility Applications*. QA for routine operations based sampling (as well as compliance and performance monitoring) will be discussed in the O&M plan, project management plan, or associated SAP (DOE/RL-2015-22) and will comply with the following requirements:

- DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Document*
- DOE O 414.1D

All SAPs prepared to support the RA will contain a QA project plan, which establishes the quality requirements for environmental data collection, including planning, implementation, and assessment of sampling, field measurements, and laboratory analysis.

A construction quality assurance plan (CQAP) will be prepared by the designer, in accordance with EPA 530-SW-86-031, *Technical Guidance Document: Construction Quality Assurance for Hazardous Waste Land Disposal Facilities*, and submitted as part of the prefinal/final design report. The CQAP describes the QA tests necessary to ensure that the final product meets design specifications. The tests are used to provide quantitative criteria with which to accept the final product. Construction QA is the responsibility of the contracting party and takes place throughout the construction process.

The CQAP, at a minimum, will contain the following elements:

- Lines of authority and responsibilities of all key personnel involved in the RA
- Construction QA personnel qualification requirements
- List of inspection activities, including the summary, scope, and frequency of the tests and observations used to monitor the RA and verify compliance with environmental requirements and customary construction practices, *Occupational Safety and Health Act of 1970*, building and safety codes, or other applicable standards
- All documentation requirements for reporting construction QA activities, including daily summary reports and inspection data sheets
- List of construction sampling requirements

Consistent with DOE O 414.1D, the design authority will be clearly identified. The design authority will include expertise in radiochemical operations.

6 Remedial Action Completion

Chapter 6 describes the processes that will be used to determine and verify that RAOs have been attained.

6.1 Remedial Action Exit Strategy

As the waste sites are excavated to depth, they will be sampled for the COCs listed in the ROD (EPA et al., 2011) in accordance with the SAP (DOE/RL-2015-22). After sampling, a fixative or similar method will be utilized to control contamination pending approval to backfill the excavation area.

At the completion of the removal actions and backfilling, the required barriers will be installed. The following documentation will be provided for each waste site:

- Description of current waste site condition
- Basis for reclassification
- Analytic data or data references (if applicable)
- Response action completion report

6.1.1 Attainment of Remedial Action Objectives

RAOs 1, 2, and 3 (as defined in Chapter 2) will be achieved by completion of the RAs. Table 6-1 summarizes the RA for each waste site in the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs.

Table 6-1. Summary of RAs at the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OU Waste Sites

Waste Site	Design Depth per ROD*	COCs per ROD*	Backfill to Original Grade	Revegetate	ET Barrier
200-CW-5 OU					
216-Z-1D Ditch	4.6 m (15 ft) bgs	Sr-90, Cs-137, Ra-226, Pu-239/240, Am-241, Boron, Mercury, PCB, Nitrate	X	X	NA
216-Z-11 Ditch	4.6 m (15 ft) bgs	Sr-90, Cs-137, Ra-226, Pu-239/240, Am-241, Boron, Mercury, PCB, Nitrate	X	X	NA
216-Z-19 Ditch	4.6 m (15 ft) bgs	Sr-90, Cs-137, Ra-226, Pu-239/240, Am-241, Boron, Mercury, PCB, Nitrate	X	X	NA
216-Z-20 Tile Field	4.6 m (15 ft) bgs	Sr-90, Cs-137, Ra-226, Pu-239/240, Am-241, Boron, Mercury, PCB, Nitrate	X	X	NA
UPR-200-W-110 Unplanned Release	4.6 m (15 ft) bgs	Sr-90, Cs-137, Ra-226, Pu-239/240, Am-241, Boron, Mercury, PCB, Nitrate	X	X	NA
200-W-207-PL Pipeline	Remove structure	Sr-90, Cs-137, Ra-226, Pu-239/240, Am-241, Boron, Mercury, PCB, Nitrate	X	X	NA

Table 6-1. Summary of RAs at the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OU Waste Sites

Waste Site	Design Depth per ROD*	COCs per ROD*	Backfill to Original Grade	Revegetate	ET Barrier
200-PW-1 OU					
216-Z-1A Tile Field	6.1 m (20 ft) bgs	Tc-99, Pu-239/240, Am-241, Nitrate	X	NA	X
216-Z-9 Trench	7 m (23 ft) bgs	Tc-99, Pu-239/240, Am-241, Nitrate	X	NA	X
216-Z-18 Crib	6.1 m (20 ft) bgs	Tc-99, Pu-239/240, Am-241, Nitrate	X	NA	X
200-W-174-PL Pipeline	Remove structure	Tc-99, Pu-239/240, Am-241, Nitrate	X	NA	X
200-W-206-PL Pipeline	Remove structure	Tc-99, Pu-239/240, Am-241, Nitrate	X	NA	X
216-Z-1&2 Crib	7.6 m (25 ft) bgs	Tc-99, Pu-239/240, Am-241, Nitrate	X	NA	X
216-Z-3 Crib	10.1 m (33 ft) bgs	Tc-99, Pu-239/240, Am-241, Nitrate	X	NA	X
216-Z-12 Crib	7.3 m (24 ft) bgs	Pu-239/240, Am-241	X	NA	X
241-Z-361 Settling Tank	Remove structure	Pu-239/240, Am-241	X	X	NA
200-PW-3 OU					
216-A-7 Crib	NA	Cs-137	Enhance soil cover as needed	X	NA
216-A-8 Crib	NA	Cs-137	Enhance soil cover as needed	X	NA
216-A-24 Crib	NA	Cs-137	Enhance soil cover as needed	X	NA
216-A-31 Crib	NA	Cs-137	Enhance soil cover as needed	X	NA
UPR-200-E-56 Unplanned Release	NA	Cs-137	Enhance soil cover as needed	X	NA
200-PW-6 OU					
216-Z-5 Crib	6.7 m (22 ft) bgs	Pu-239/240, Am-241	X	NA	X
200-W-208-PL Pipeline	Remove structure	Pu-239/240, Am-241	X	NA	X

Table 6-1. Summary of RAs at the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OU Waste Sites

Waste Site	Design Depth per ROD*	COCs per ROD*	Backfill to Original Grade	Revegetate	ET Barrier
200-W-210-PL Pipeline	Remove structure	Pu-239/240, Am-241	X	NA	X
241-Z-8 Settling Tank	Remove structure	Pu-239/240, Am-241	X	X	NA
200-W-205-PL Pipeline	Remove structure	Pu-239/240, Am-241	X	X	NA
200-W-220-PL Pipeline	Remove structure	Pu-239/240, Am-241	X	X	NA
216-Z-8 French Drain	No action	NA	NA	NA	NA
216-Z-10 Injection/ Reverse Well	No action	NA	NA	NA	NA

* EPA et al., *Record of Decision Hanford 200 Area Superfund Site 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*.

Am-241	=	americium-241	PCB	=	polychlorinated biphenyl
bgs	=	below ground surface	Pu-239/240	=	plutonium-239/240
COC	=	contaminant of concern	RA	=	remedial action
Cs-137	=	cesium-137	Ra-226	=	radium-226
ET	=	evapotranspiration	ROD	=	record of decision
NA	=	not applicable	Sr-90	=	strontium-90
OU	=	operable unit	Tc-99	=	technetium-99

6.1.2 Verify Attainment of the Remedial Action Objectives

The analytical results used to verify attainment of RAOs will be derived from systematic radiological surveys supported by focused sampling, statistical sampling, or a combination of both. Radiological survey data will be obtained from the waste site excavations either as the excavation progresses or after excavation. The data will be plotted using global positioning system data to produce concentration maps of the radiological contaminants. Judgmental sampling will be used to verify the radiological surveys and provide information on the nature and extent of chemical constituents.

Results of the systematic radiological surveys of the excavation will be used to determine the variance of the COCs. A statistical sample design will be implemented to meet the performance goals. The minimum number of samples needed for each decision unit is determined based on the minimum-detectable-difference approach presented in EPA 230-R-94-004, *Statistical Methods For Evaluating The Attainment Of Cleanup Standards, Volume 3: Reference-Based Standards For Soils And Solid Media*. Statistical sampling uses composite values and summary statistics for decision making. Site-specific work instructions (sampling designs) will be prepared for each waste site.

The general approach for verifying attainment of RAOs involves the following steps:

- Identify the unit(s) within a site for cleanup verification.
- Calculate the summary statistics for the identified unit(s) using a statistical sampling design.
- Identify the appropriate cleanup levels to be applied to the unit(s).
- Evaluate the summary statistics, as appropriate, for the identified unit(s) against the decision rules for achieving the appropriate cleanup levels.
- Verify that radionuclide soil concentrations are less than the radionuclide soil cleanup standard for direct exposure.
- Verify the attainment of the nonradionuclide soil concentrations corresponding to the 2007 WAC 173-340-745(5), "Soil Cleanup Standards for Industrial Properties," for direct contact.
- Verify that radionuclide soil concentrations are less than the concentrations predicted to be protective of groundwater and the Columbia River.
- Verify that nonradionuclide contaminant concentrations in soil are less than the concentrations predicted to be protective of groundwater and the Columbia River.
- Report the results of evaluations against ecological soil screening values.

Details regarding verification sampling and analysis may be found in the SAP (DOE/RL-2015-22).

6.1.2.1 Identify the Unit(s) within a Site for Cleanup Verification

In this step, the site is divided into units for purposes of collecting verification samples. Summary statistics (e.g., arithmetic mean and 95 percent upper confidence limit [UCL]) are calculated for verification samples from a particular unit. Verification sampling and analysis data will be evaluated against the decision rules (Section 6.1.2.4) on a unit-by-unit basis. Generally, a site will be divided into the following units: soil at depths <4.6 m (15 ft) bgs and overburden (stockpiled) soil that will be returned to the excavation. Additional units may be defined, as needed, for large sites or other specific needs. Overburden (stockpiled) soil from multiple waste sites may be combined into a single common overburden pile or multiple common overburden piles. These units will be identified in instructions prepared for verification sampling. Details regarding verification sampling and analysis can be found in the SAP (DOE/RL-2015-22).

6.1.2.2 Calculate the Summary Statistics for the Identified Unit(s) Using a Statistical Sampling Design

The summary statistics needed for each unit are arithmetic mean, standard deviation, single-sided 95 percent UCL, and the total number of samples collected from the unit. The 95 percent UCL for the mean and associated summary statistics will be calculated for each COC using ProUCL (EPA/600/R-07/041, *ProUCL Version 5.0.00 User Guide*). The number of samples with concentrations exceeding the 2007 WAC 173-340-745(5) cleanup level and two times the 2007 WAC 173-340 cleanup level must also be determined from the sampling and analytical data.

6.1.2.3 Identify the Appropriate Cleanup Levels To Be Applied to the Unit(s)

Cleanup levels that apply to a site must be identified to verify that the remedial action has attained RAOs. A review of Section 2.3 (Chapter 2) provides the necessary information to identify the appropriate cleanup levels. One or more of these goals may apply to any particular unit. Chemical-specific cleanup levels (e.g., for metals, volatile organic analytes, and semivolatile organic compounds) will be calculated for site verification.

6.1.2.4 Evaluate the Data Against the Decision Rules for Achieving the Appropriate Remedial Action Goals

For cleanup levels identified in the previous step, decision rules are defined that will be used to test verification sampling and analysis data. For statistical sampling designs, the following decision rules are as applied:

- 2007 WAC 173-340-745(5) cleanup standards are achieved under the following conditions:
  - The 95 percent UCL on the arithmetic mean from verification samples collected is less than the cleanup standard for each COC.
  - No single sample concentration is greater than two times the cleanup standard.
  - Less than 10 percent of the sample concentrations exceed the cleanup standard.
- Radionuclide soil cleanup standards are achieved when the concentration calculated from the 95 percent UCL on the arithmetic mean for the sum of all radioactive COCs from verification samples collected from the decision unit is less than the risk-based cleanup levels.
- For nonradioactive contaminants, cleanup of soils for groundwater protection will have been achieved when the 95 percent UCL on the arithmetic mean concentration for each COC is less than the cleanup level developed areas using the graded approach (DOE/RL-2011-50, *Regulatory Basis and Implementation of a Graded Approach to Evaluation of Groundwater Protection*).
- For radionuclide contaminants, cleanup of soils for groundwater protection will have been achieved when the 95 percent UCL on the arithmetic mean concentration for each COC is less than the cleanup level developed areas using the graded approach (DOE/RL-2011-50).

6.2 Contingency Action Plan

It is expected that after the waste sites are excavated to depth, some of the waste sites (e.g., 216-Z-9, 216-Z-12, 216-Z-18, and the 216-Z-1A, 216-Z-1, 216-Z-2, and 216-Z-3 cluster) will have levels of contamination that exceed the cleanup criteria. After excavating to the specified depths in these waste sites, plutonium-239/240 levels will be assessed in accordance with the SAP (DOE/RL-2015-22) that accompanies this RD/RAWP. DOE will consider removing additional plutonium contaminated soil from these waste sites.

6.3 CERCLA Cleanup Documentation

Subsequent to RA, cleanup verification reports will be prepared. The reports will provide the needed documentation for verification of RA at the sites and will support the eventual deletion of the OU from the NPL (40 CFR 300, Appendix B). Cleanup verification reports will be prepared for groups of sites or individual sites, as needed. At a minimum, the following is required for each waste site:

- Description of current waste site condition (including descriptions of completed activities and underlying soil status)
- Basis for reclassification
- Analytic data or data references (if applicable)

Regulatory approval will be documented on a waste site reclassification form, which is accompanied by a regulator reviewed site-specific informal report. Supporting documentation (e.g., calculations and memoranda to the file explaining field investigation efforts) will be held in records retention for retrieval, if ever required. The Waste Information Data System will serve as formal notification to the public that the site is no longer a candidate for RA and does not exceed RAOs established in the ROD (EPA et al., 2011).

6.4 Remedy Final Inspection and Site Completion Report

The lead regulatory agency project manager will conduct a final inspection based on the results of the prefinal inspections and the content of prefinal inspection reports. Final inspections will verify the closure of open items from the prefinal inspections and will confirm and document that remediation goals have been met. The final inspection, conducted by agency project managers, will confirm the resolution of outstanding items identified in the prefinal inspection and verify that the remediation has been completed in accordance with the requirements of the ROD (EPA et al., 2011).

At the discretion of the lead regulatory agency, results of the final inspection may be incorporated in the site's completion report. Information collected as part of the final inspection and final inspection report will be collected during a prefinal inspection and prefinal inspection report. The final inspection report will contain the following elements:

- Results of the final inspection
- Evaluation of the effectiveness in meeting treatment system performance requirements based on the results of the shakedown period
- O&M plan update

7 Cost and Schedule

Chapter 7 provides an overview of the estimated cost and schedule for implementing the remedial design and tasks described in Chapters 3 and 4 and the management and controls described in Chapter 5.

7.1 Cost Summary

A cost estimate was prepared by an interdisciplinary team to determine the resource quantities and predict the expected cost to complete the RA work scope. A project schedule and WBS were developed and used as the framework for the cost estimate. A programmatic risk analysis was performed to calculate the amount of contingency necessary to achieve an 80 percent confidence in the cost estimate. This unrealized risk contingency has been included in the estimate. The detailed basis of estimate is included in Appendix C.

The cost of the RA is expected to fall within the -20 percent ($836,000,000) to +30 percent ($1,254,000,000) range, which is consistent with a Class III feasibility study type of estimate per DOE G 413.3-21, *Cost Estimating Guide*. A cost summary organized by the WBS is provided in Table 7-1. The project costs are summed in Task 1 (top row), "Remediate 200-CW-5 and 200-PW-1/3/6 Operable Units."

The RD/RAWP cost estimate for implementing the ROD (EPA et al., 2011) is approximately $1.05 billion in fiscal year (FY) 2015 dollars compared to the ROD estimate of $646 million in FY 2008 dollars, which when escalated, equates to $758 million in FY 2015 dollars. The ROD estimate consists of two parts: one is the actual cost of cleanup ($352 million), and the other is the long-term O&M cost ($406 million). The RD/RAWP cost for cleanup is $1.0 billion, and the long-term stewardship cost is $40 million.

The following primary drivers account for the difference in cost (comparisons use the escalated ROD [EPA et al., 2011] values):

- Project management costs are estimated at ~$115M in the RD/RAWP compared with ~$40M in the ROD (EPA et al., 2011). RD/RAWP assumes full time project management team for about 20 years and the ROD assumed a part time project management team. Contingency in the RD/RAWP is $~80M compared with ~$30M in the ROD (EPA et al., 2011).

- Acquisition and mobilization costs are estimated at ~$280M in the RD/RAWP compared with ~$40M in the ROD (EPA et al., 2011). The ROD (EPA et al., 2011) assumed open air excavation using standard industrial equipment resulting in minimal acquisition. Based on input from radiological controls and environmental engineering, the RD/RAWP assumes excavation within a contamination control structure. The RD/RAWP assumes that the remediation system (e.g., weather enclosures and contamination control structures) will be Category 2 nuclear facilities, that technology will need to be developed and demonstrated, and that the acquisition of the remediation systems will involve a capital line item.

- Remove, treat, and dispose of contaminated soil and debris costs are estimated at $~510M in the RD/RAWP compared with ~$240M in the ROD (EPA et al., 2011). The excavation volume calculated in the RD/RAWP is ~430,000 m^3, and the volume calculated in the ROD (EPA et al., 2011) is ~260,000 m^3. The volume of TRU waste calculated in the RD/RAWP is ~6,000 m^3, and the volume calculated in the ROD (EPA et al., 2011) is ~2,300 m^3. TRU waste management costs in the RD/RAWP include ~$50M for CWC receipt and storage. TRU waste management costs in the ROD (EPA et al., 2011) include ~$115M for CWC receipt and storage, WIPP certification, WIPP shipment, and WIPP disposal. In addition, in the RD/RAWP an operating efficiency based on production rates and efficiency experienced at other similar DOE remediation sites was applied to the production schedule. Operating efficiency was not considered in the ROD (EPA et al., 2011).

- Remove, treat, and dispose of the settling tanks costs are estimated at $~60M in the RD/RAWP compared with ~$30M in the ROD (EPA et al., 2011). Due to uncertainties with the structural integrity of the settling tanks, the RD/RAWP assumes that removing the sludge, stabilizing the settling tanks, and closing the settling tanks in place is not a viable alternative. Therefore, the RD/RAWP RA for the settling tanks includes removal of the sludge and the tanks. In the ROD, the RA for the settling tanks is to remove sludge, stabilize the tanks, and close the tanks in place.
- Long-term stewardship costs in the RD/RAWP are estimated at ~40M compared with ~$400M in the ROD (EPA et al., 2011). The RD/RAWP used the institutional control costs from ECF-Hanford-12-0067, Rev. 0 divided by 22 OUs for 150 years. In the ROD (EPA et al., 2011), long-term stewardship includes O&M costs which were presented as total Nondiscounted Annual and Periodic Costs and include 1,000-year IC/O&M. In this area, the ROD costs are ~$360 million more than the RD/RAWP costs.

7.2 Schedule

The summary schedule shown in Figure 7-1 was developed based on the WBS scope, requirements, and assumptions identified in Chapter 4. The overall schedule duration is approximately 20 years.

The schedule critical path is based on acquisition of the remediation systems (which will involve a capital line item that requires congressional approval), completion of operational readiness reviews, RTD of contaminated soil and debris, RTD of the settling tanks, and installation of ET barriers. Schedules for hiring and qualification of staff and completion of other preparations, including DSA modifications, contain minimal deviation from the critical path. The actual sequence of activities will continue to be evaluated as the design matures and will be adjusted as appropriate to reflect evolving cleanup priorities.

Table 7-1. RA Cost Estimate for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs

Task No.	Task Name	Total ($M)	Cost per Project Year ($M)																				
			FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031	FY 2032	FY 2033	FY 2034	FY 2035 +	
1	Remediate 200-CW-5 and 200-PW-1/3/6 Operable Units	$1,045			$5	$28	$35	$58	$60	$62	$62	$65	$70	$70	$70	$70	$70	$70	$70	$66	$57	$56	
1.1	Manage 200-CW-5 and 200-PW-1/3/6 Remediation																						
1.1.1	Project Management and Support for 200-CW-5 and 200-PW-1/3/6 Remediation	$116			$2	$5	$7	$7	$7	$7	$7	$7	$7	$7	$7	$7	$7	$7	$7	$7	$7	$2	
1.1.2	Acquire Remediation System for 200-CW-5 and 200-PW-1/3/6	$281			$3	$22	$28	$51	$51	$51	$51	$25											
1.1.3	Mobilize Remediation System for 200-CW-5 and 200-PW-1/3/6	$12							$2	$5	$5												
1.2	Remove, Treat, and Dispose of Contaminated Soil and Debris	$509										$33	$63	$63	$63	$63	$63	$63	$63	$19	$15		
1.3	Remove, Treat, and Dispose of Settling Tanks	$58																		$29	$23	$6	
1.4	Enhance Soil Cover, Install ET Barriers, and Demobilize the Project	$28																		$11	$11	$6	
1.5	Long-Term Stewardship	$42																				$42	

ET = evapotranspiration

OU = operable unit

RA = remedial action

No.	Task Name
1	Remediate 200-CW-5 and 200-PW-1/3/6 Operable Units
1.1	Manage 200-CW-5 and 200-PW-1/3/6 Remediation
1.1.1	Project Management and Support for 200-CW-5 and 200-PW-1/3/6 Remediation
1.1.2	Acquire Remediation System for 200-CW-5 and 200-PW-1/3/6
1.1.2.1	Request and Obtain Project Funding
1.1.2.2	CD-0, Approve Mission Need
1.1.2.3	CD-0 to CD-1, Approve Alternative Selection and Cost Range
1.1.2.4	CD-1 to CD-2, Approve Performance Baseline
1.1.2.5	CD-2 to CD-3, Approve Start of Construction/Execution
1.1.2.6	CD-3 to CD-4, Approve Start of Operations or Project Completion
1.1.3	Mobilize Remediation System for 200-CW-5 and 200-PW-1/3/6
1.2	Remove, Treat, and Dispose of Contaminated Soil and Debris
1.2.1	Manage RTD of Contaminated Soil and Debris
1.2.2	RTD of Soil and Debris from Z Ditches
1.2.3	RTD of Soil and Debris from 216-Z-5
1.2.4	RTD of Soil and Debris from 216-Z-18
1.2.5	RTD of Soil and Debris from 216-Z-9
1.2.6	RTD of Soil and Debris from 216-Z-12
1.2.7	RTD of Soil and Debris from 216-Z-1A, Z-1, Z-2, and Z-3
1.3	Remove, Treat, and Dispose of Settling Tanks
1.3.1	Manage RTD of Settling Tanks
1.3.2	RTD of Tank 241-Z-8
1.3.3	RTD of Tank 241-Z-361
1.4	Enhance Soil Cover, Install ET Barriers, and Demobilize the Project
1.4.1	Manage Enhance Soil Cover, Install ET Barriers, and Demobilize the Project
1.4.2	Enhance Soil Cover for Cs-137 Waste Sites
1.4.3	Install ET Barriers
1.4.4	Demobilize the Project
1.5	Long-Term Stewardship
1.5.1	Manage Long-Term Stewardship
1.5.2	Institutional Controls
1.5.3	Surveillance, Operations, and Maintenance
1.5.4	CERCLA 5-Year Review

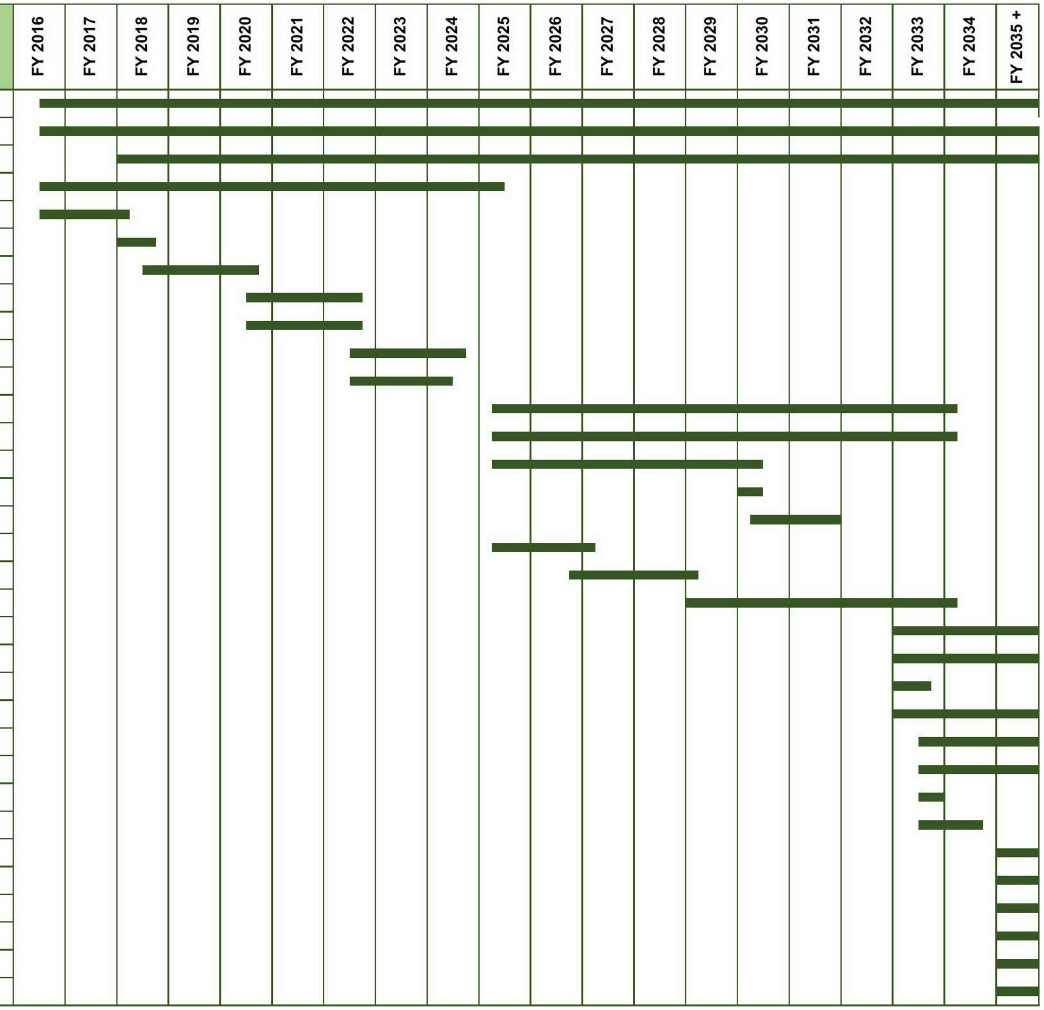

Figure 7-1. RA Schedule for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 OUs

8 References

10 CFR 71, "Packaging and Transportation of Radioactive Material," *Code of Federal Regulations*. Available at: http://www.gpo.gov/fdsys/pkg/CFR-2010-title10-vol2/xml/CFR-2010-title10-vol2-part71.xml.

10 CFR 830, "Nuclear Safety Management," *Code of Federal Regulations*. Available at: http://www.gpo.gov/fdsys/pkg/CFR-2010-title10-vol4/xml/CFR-2010-title10-vol4-part830.xml.

Subpart A, "Quality Assurance Requirements."

10 CFR 835, "Occupational Radiation Protection," *Code of Federal Regulations*. Available at: http://www.gpo.gov/fdsys/pkg/CFR-2010-title10-vol4/xml/CFR-2010-title10-vol4-part835.xml.

10 CFR 851, "Worker Safety and Health Program," *Code of Federal Regulations*. Available at: http://www.gpo.gov/fdsys/pkg/CFR-2010-title10-vol4/xml/CFR-2010-title10-vol4-part851.xml.

CFR 1021, "National Environmental Policy Act Implementing Procedures," Code of Federal Regulations. Available at: https://www.gpo.gov/fdsys/pkg/CFR-2010-title10-vol4/xml/CFR-2010-title10-vol4-part1021.xml

29 CFR 1910.120, "Occupational Safety and Health Standards," "Hazardous Waste Operations and Emergency Response," *Code of Federal Regulations*. Available at: http://edocket.access.gpo.gov/cfr_2005/julqtr/pdf/29cfr1910.120.pdf.

40 CFR 61, "National Emission Standards for Hazardous Air Pollutants," *Code of Federal Regulations*. Available at: http://www.gpo.gov/fdsys/pkg/CFR-2010-title40-vol8/xml/CFR-2010-title40-vol8-part61.xml.

61.92, "National Emission Standards for Hazardous Air Pollutants."

Subpart H, "National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities."

40 CFR 268, "Land Disposal Restrictions," *Code of Federal Regulations*. Available at: http://www.gpo.gov/fdsys/pkg/CFR-2010-title40-vol26/xml/CFR-2010-title40-vol26-part268.xml.

268.44, "Variance from a Treatment Standard."

40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," *Code of Federal Regulations*. Available at: http://www.gpo.gov/fdsys/pkg/CFR-2010-title40-vol27/xml/CFR-2010-title40-vol27-part300.xml.

300.5, "Definitions."

40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," Appendix B, "National Priorities List," *Code of Federal Regulations*. Available at: http://www.gpo.gov/fdsys/pkg/CFR-2010-title40-vol27/xml/CFR-2010-title40-vol27-part300-appB.xml.

64 FR 61615, "Record of Decision: Hanford Comprehensive Land-Use Plan Environmental Impact Statement (HCP EIS)," *Federal Register*, Vol. 64, No. 218, pp. 61615-61625, November 12, 1999. Available at: http://www.gpo.gov/fdsys/pkg/FR-1999-11-12/pdf/99-29325.pdf.

ASME AG-1-2012, 2013, *Code on Nuclear Air and Gas Treatment*, American Society of Mechanical Engineers, New York, New York. Available at:

ASME NQA-1, 2008 *Quality Assurance Requirements for Nuclear Facility Applications*

ASME NQA-1A-2009 *Code on Nuclear Air and Gas Treatment*

Clean Air Act of 1990, Pub. L. 101-549, as amended, 42 USC 7401, et seq. Available at: http://www.epa.gov/air/caa/.

Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 USC 9601 et seq., Pub. L. 107-377, December 31, 2002. Available at: http://epw.senate.gov/cercla.pdf.

Section 104, "Response Authorities."

Section 121, "Cleanup Standards."

DOE G 413.3-21, 2011, *Cost Estimating Guide*, U.S. Department of Energy, Washington, D.C. Available at: https://www.directives.doe.gov/directives-documents/400-series/0413.3-EGuide-21.

DOE M 460.2-1A, 2008, *Radioactive Material Transportation Practices Manual for Use with DOE O 460.2A*, U.S. Department of Energy, Washington, D.C. Available at: https://www.emcbc.doe.gov/Content/Office/doe_m_460.2_1a.pdf.

DOE O 413.3B, 2010, *Program and Project Management for the Acquisition of Capital Assets*, U.S. Department of Energy, Washington, D.C. Available at: http://science.energy.gov/~/media/opa/pdf/processes-and-procedures/doe/o4133bFinal112910.pdf.

DOE O 414.1D, 2011, *Quality Assurance*, U.S. Department of Energy, Washington, D.C. Available at: https://www.directives.doe.gov/directives/0414.1-BOrder-d/view.

DOE O 425.1D, 2011, *Verification of Readiness to Start Up or Restart Nuclear Facilities*, U.S. Department of Energy, Washington, D.C. Available at: http://energy.gov/sites/prod/files/2013/06/f1/O-425-1D_ssm.pdf.

DOE O 426.2, 2011, *Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities*, U.S. Department of Energy, Washington, D.C. Available at: http://energy.gov/sites/prod/files/2013/06/f1/O-426-2_ssm.pdf.

DOE O 460.1C, 2011, *Packaging and Transportation Safety*, U.S. Department of Energy, Washington, D.C. Available at: http://energy.gov/sites/prod/files/2013/06/f1/O-460-1C_O-460-2A_ssm.pdf.

DOE/EIS-0222-F, 1999, *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement*, U.S. Department of Energy, Washington, D.C. Available at:
http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=D199158842.
http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=D199158843.
http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=D199158844.
http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=D199158845.
http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=D199158846.
http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=D199158847.

DOE/RL-91-50, 2013, *Hanford Site Environmental Monitoring Plan*, Rev. 6A, U.S. Department of Energy, Richland Operations Office, Richland, Washington. http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=1503160460.

DOE/RL-95-11, 1995, *Ecological Compliance Assessment Management Plan*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=D196015539.

DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Document (HASQARD)*, *Volume 1, Administrative Requirements*; *Volume 2, Sampling Technical Requirements*; *Volume 3, Field Analytical Technical Requirements*; and *Volume 4, Laboratory Technical Requirements*, U.S. Department of Energy, Richland Operations Office, Richland, Washington. http://www.hanford.gov/files.cfm/DOE-RL-96-68-VOL1-04.pdf

DOE/RL-2001-36, 2011, *Hanford Sitewide Transportation Safety Document*, Rev. 1-E, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2001-41, 2015, *Sitewide Institutional Control Plans for Hanford CERCLA Response Actions and RCRA Corrective Actions*, Rev. 8, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0081640H.

DOE/RL-2003-11, 2004, *Remedial Investigation Report for the 200-CW-5 U Pond/Z Ditches Cooling Water Group, the 200-CW-2 S Pond and Ditches Cooling Water Group, the 200-CW-4 T Pond and Ditches Cooling Water Group, and the 200-SC-1 Steam Condensate Group Operable Units*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=1111300811.

DOE/RL-2004-24, 2011, *Feasibility Study for the 200-CW-5 Cooling Water Operable Unit*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0093826.

DOE/RL-2006-29, 2010, *Calculating Potential-to-Emit Radiological Releases and Doses*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=1009270905.

DOE/RL-2006-51, 2007, *Remedial Investigation Report for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at:
http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=DA05807591.
http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=DA05807868.
http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0805130070.
http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0805130071.

DOE/RL-2007-27, 2011, *Feasibility Study for the Plutonium/Organic-Rich Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at:
http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0093807.
http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0093806.

DOE/RL-2011-50, 2012, *Regulatory Basis and Implementation of a Graded Approach to Evaluation of Groundwater Protection*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at:
http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0093361.

DOE/RL-2014-48, 2015, *Endpoint Evaluation for the 200-PW-1 Operable Unit Soil Vapor Extraction System Operations*, Draft A, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at:
http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0079694H

DOE/RL-2015-22, 2015, *Sampling and Analysis Plan for the 200-CW-5, 200-PW-1, and 200-PW-6 Operable Units*, Decisional Draft, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-STD-1189-2008, 2008, *Integration of Safety Into the Design Process*, DOE Standard, U.S. Department of Energy, Washington, D.C. Available at:
http://energy.gov/sites/prod/files/2013/06/f1/DOE-STD-1189-2008.pdf.

DOE-STD-3006-2010, 2010, *Planning and Conducting Readiness Reviews*, DOE Standard, U.S. Department of Energy, Washington, D.C. Available at:
http://energy.gov/sites/prod/files/2013/06/f1/doe-std-3006-2010.pdf.

DOE/WIPP-02-3122, 2013, *Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant*, Rev. 7.4, U.S. Department of Energy, Carlsbad Field Office, Carlsbad, New Mexico. Available at: http://www.wipp.energy.gov/library/wac/wac.pdf.

ECF-Hanford-12-0067, 2012, *Institutional Controls Costs Apportioned by ROD Groups*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at:
http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0090729.

Ecology, EPA, and DOE, 1989a, *Hanford Federal Facility Agreement and Consent Order*, as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington. Available at:
http://www.hanford.gov/page.cfm/TriParty/TheAgreement.

Ecology, EPA, and DOE, 1989b, *Hanford Federal Facility Agreement and Consent Order Action Plan*, as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington. Available at: http://www.hanford.gov/?page=82.

EPA, Ecology, and DOE, 2011, *Record of Decision Hanford 200 Area Superfund Site 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0093644.

EPA 230-R-94-004, 1992, *Statistical Methods For Evaluating The Attainment Of Cleanup Standards, Volume 3: Reference-Based Standards For Soils And Solid Media*, Environmental Statistics and Information Division, Office of Policy, Planning, and Evaluation, U.S. Environmental Protection Agency, Washington, D.C. Available at: http://nepis.epa.gov/Exe/ZyNET.exe/230-R-94-004
.

EPA/240/B-01/003, 2001, *EPA Requirements for Quality Assurance Project Plans*, EPA QA/R-5, Office of Environmental Information, U.S. Environmental Protection Agency, Washington, D.C. Available at: https://www.epa.gov/sites/production/files/2015-07/documents/r5-final.pdf

EPA 530-SW-86-031, 1986, *Technical Guidance Document: Construction Quality Assurance for Hazardous Waste Land Disposal Facilities*, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C. Available at: http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P100GB66.txt.

EPA/600/R-07/041, 2013, *ProUCL Version 5.0.00 User Guide*, Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations, Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. Available at: https://www.epa.gov/sites/production/files/2015-03/documents/proucl_v5.0_user.pdf

Executive Order 12580, 1987, *Superfund Implementation*, Ronald W. Reagan, January 23. Available at: http://www.archives.gov/federal-register/codification/executive-order/12580.html.

HNF-1744, 1999, *Radionuclide Inventories of Liquid Waste Disposal Sites on the Hanford Site*, Fluor Daniel Hanford, Inc., Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=00099930.

HNF-8735, 2002, *241-Z-361 Tank Characterization Report*, Rev. 0A, Fluor Hanford, Inc., Richland, Washington.

HNF-EP-0063, 2011, *Hanford Site Solid Waste Acceptance Criteria*, Rev. 16, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: http://www.hanford.gov/files.cfm/HNF-EP-0063_Rev16_041111_Website.pdf.

National Historic Preservation Act of 1966, Pub. L. 89-665, as amended, 16 USC 470, et seq. Available at: http://www.achp.gov/docs/nhpa%202008-final.pdf.

NQA-1, 2008, *Quality Assurance Requirements for Nuclear Facility Applications*, American Society of Mechanical Engineers, New York, New York.

NQA-1A-2009, 2009, *Addenda to Quality Assurance Requirements for Nuclear Facility Applications*, American Society of Mechanical Engineers, New York, New York.

Occupational Safety and Health Act of 1970, Pub. L. 91-596, 84 Stat. 1590, U.S. Department of Labor, Washington, D.C. Available at: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=OSHACT&p_id=3355.

PNNL-21843, *Soil Vapor Extraction System Optimization, Transition, and Closure Guidance* Pacific Northwest National Laboratory, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0088374..

RCW 70.94, "Washington Clean Air Act," *Revised Code of Washington*, Olympia, Washington. Available at: http://apps.leg.wa.gov/RCW/default.aspx?cite=70.94.

Resource Conservation and Recovery Act of 1976, 42 USC 6901, et seq. Available at: http://www.epa.gov/epawaste/inforesources/online/index.htm.

SGW-41472, 2014, *Soil and Groundwater Remediation Project Site Specific Health and Safety Plan (HASP)*, Rev. 9, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0082379H.

SGW-58692, 2015, *Data Quality Objectives for the 200-CW-5, 200-PW-1, and 200-PW-6 Operable Units*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0080808H.

Superfund Amendments and Reauthorization Act of 1986, 42 USC 103, et seq. Available at: http://epw.senate.gov/sara.pdf.

SW-846, 2007, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update IV-B*, as amended, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C. Available at: **Error! Hyperlink reference not valid.** https://www.epa.gov/hazardous-waste-test-methods-sw-846

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-303.

303-610, "Closure and Post-Closure."

WAC 173-340, "Model Toxics Control Act—Cleanup," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-340.

340-745, "Soil Cleanup Standards for Industrial Properties."

WAC 173-400, "General Regulations for Air Pollution Sources," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-400.

400-040, "General Standards for Maximum Emissions."

WAC 173-460, "Controls for New Sources of Toxic Air Pollutants," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-460

460-150, "Table of ASIL, SQER and de Minimis Emission Values."

WAC 173-480, "Ambient Air Quality Standards and Emission Limits for Radionuclides," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-480.

WAC 246-247, "Radiation Protection—Air Emissions," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=246-247.

247-040, "General Standards."

247-075, "Monitoring, Testing and Quality Assurance."

WCH-191, 2015, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*, Rev. 4 Decisional Draft, Washington Closure Hanford, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=1505210201.

WH Publication 1246, 2009, *The Davis-Bacon Act, as Amended*, Wage and Hour Division, U.S. Department of Labor, Washington, D.C. Available at: http://www.dol.gov/whd/regs/statutes/dbra.pdf.

WHC-EP-0674, 1993, *Groundwater Impact Assessment Report for the 216-Z-20 Crib, 200 West Area*, Westinghouse Hanford Company, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=D196107877.

This page intentionally left blank.

Appendix A

200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Unit Waste Site Descriptions

This page intentionally left blank.

Contents

Figures

Tables

Terms

bgs	below ground surface
DNAPL	dense, nonaqueous-phase liquid
NPH	normal paraffin hydrocarbon
OU	operable unit
PFP	Plutonium Finishing Plant
PRF	Plutonium Reclamation Facility
PUREX	Plutonium Uranium Extraction
RD/RAWP	remedial design/remedial action work plan
RECUPLEX	Recovery of Uranium and Plutonium by Extraction
SVE	soil vapor extraction
TBP	tributyl phosphate
UPR	unplanned release0707

This page intentionally left blank.

A1 Waste Site Description

The existing waste sites within the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units (OUs) are described within this appendix. The project boundaries and waste sites within the 200 East and 200 West Areas for these OUs are depicted in Figures 1-3 and 1-4, respectively.

A1.1 200-CW-5 Operable Unit

The 200-CW-5 OU waste sites include the 216-Z-1D Ditch, 216-Z-11 Ditch, 216-Z-19 Ditch, 216-Z-20 Tile Field, and Unplanned Release (UPR)-200-W-110. Remediation of waste sites in this OU will also address the 200-W-207 Pipeline. This pipeline was used to transfer waste to the 216-Z-1D Ditch, 216-Z-11 Ditch, 216-Z-19 Ditch, and 216-Z-20 Tile Field. Figure A-1 shows the location of the 200-CW-5 OU waste sites in the 200 West Area. The 200-CW-5 OU is a process-based OU established to address waste sites that received cooling water and steam condensate liquid waste streams from plutonium processing facilities in the 200 West Area. The exception was UPR-200-W-110, which did not receive effluent but was a one-time-use disposal trench for spoils from the 216-Z-1D Ditch and contained the same waste stream contaminants. Excavated views of the north and south end of the Z Ditches, including wells and boreholes, are depicted in Figures A-2 and A-3, respectively.

The Z Ditches are a series of three parallel, shallow, unlined, and open-air ditches that operated in chronological sequence from 1944 to 1981. The ditches routed cooling water and other wastewaters from the 234-5Z Facility (Z Plant) to the 216-U-10 Pond for disposal. From 1944 to 1956, the ditch system was used to convey cooling water effluents from the 231-Z Plutonium Isolation Plant where concentrated plutonium from the bismuth phosphate process at the 221-T Plant was processed from a wet nitrate form to a solid plutonium nitrate form for offsite shipment.

After 1956, when the bismuth phosphate process was shut down, the 231-Z Plutonium Isolation Plant was converted for use on other projects, including metallurgical studies, weapons component fabrications, and reactor fuel development. These processes generated process equipment and vessel cooling water and steam condensate waste streams that, due to coil failures and occasional process upsets, sometimes were contaminated with radionuclides.

Initially, cooling water waste streams were not anticipated to be contaminated. The cooling water and steam condensate was designed to be entirely separate from contaminated process liquids. This was accomplished with physical barriers, which were typically the walls of a heating or cooling pipe coil.

Steam and cooling water were circulated through coils inside process vessels to adjust the temperatures in the vessels. The spent steam was condensed with cooling water after exiting the process vessel. The condensed steam and cooling water were released to plant sewers or piping systems that discharged to ditches and ponds.

Although these cooling water streams did not contact process materials or chemicals under normal operating conditions, these streams became contaminated with low concentrations of radionuclides and/or chemicals. Over time, coils that circulated steam and cooling water inside chemical process tanks developed pinhole leaks and hairline cracks because of the corrosive chemicals and high thermal gradients in these tanks. These minor defects usually did not lead to contamination of the steam and cooling water because the pressure in the pipe coils was greater than the pressure in the process or condenser vessels. However, whenever the pressure in the coils was reduced or suspended, minor leakage through the flaws into the coils led to waste stream contamination. Other accidental releases from causes such as operator error also have contributed to contamination of the effluents discharged to the waste facilities in these OUs.

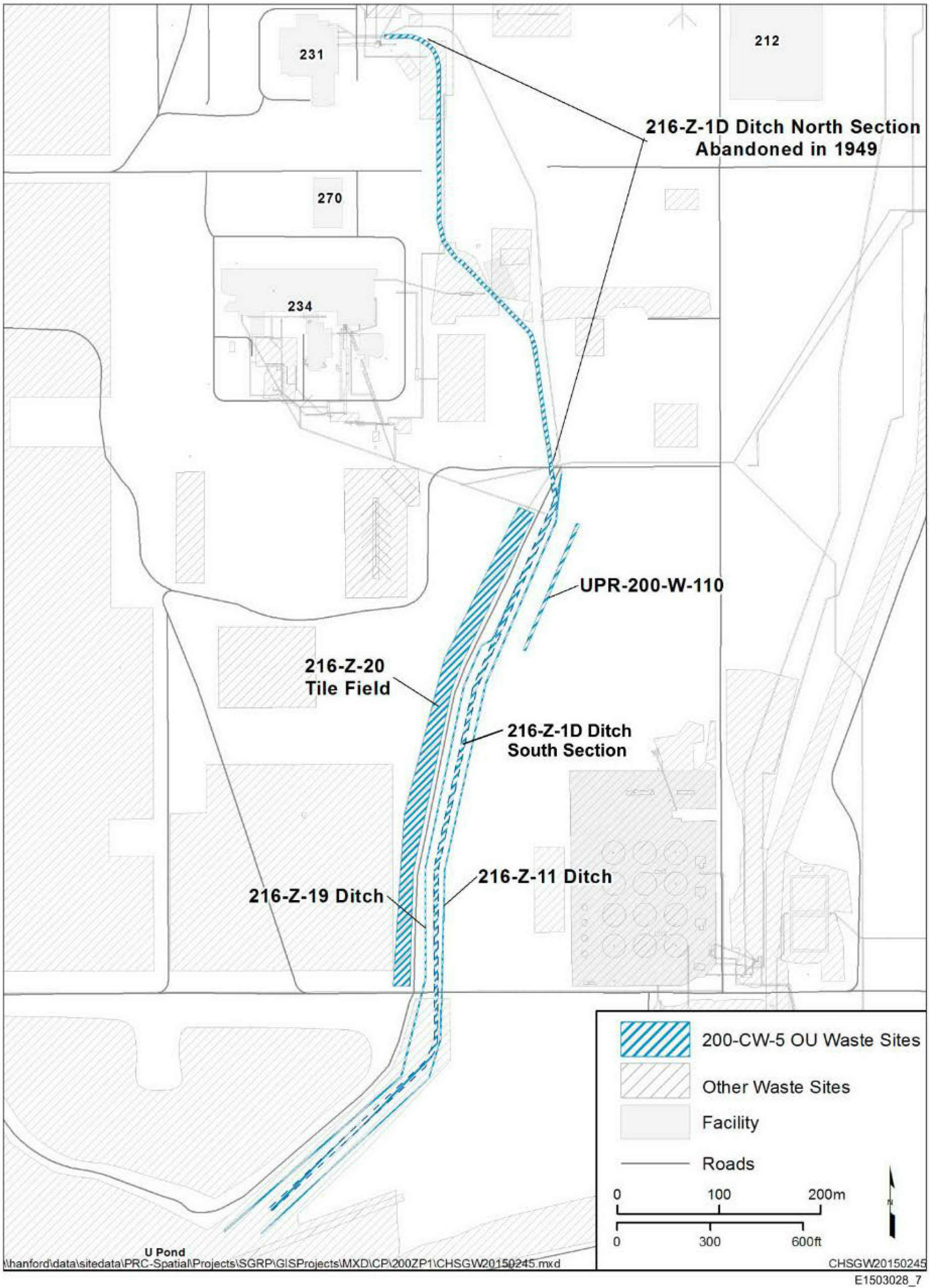

Figure A-1. Location of the 200-CW-5 OU Waste Sites

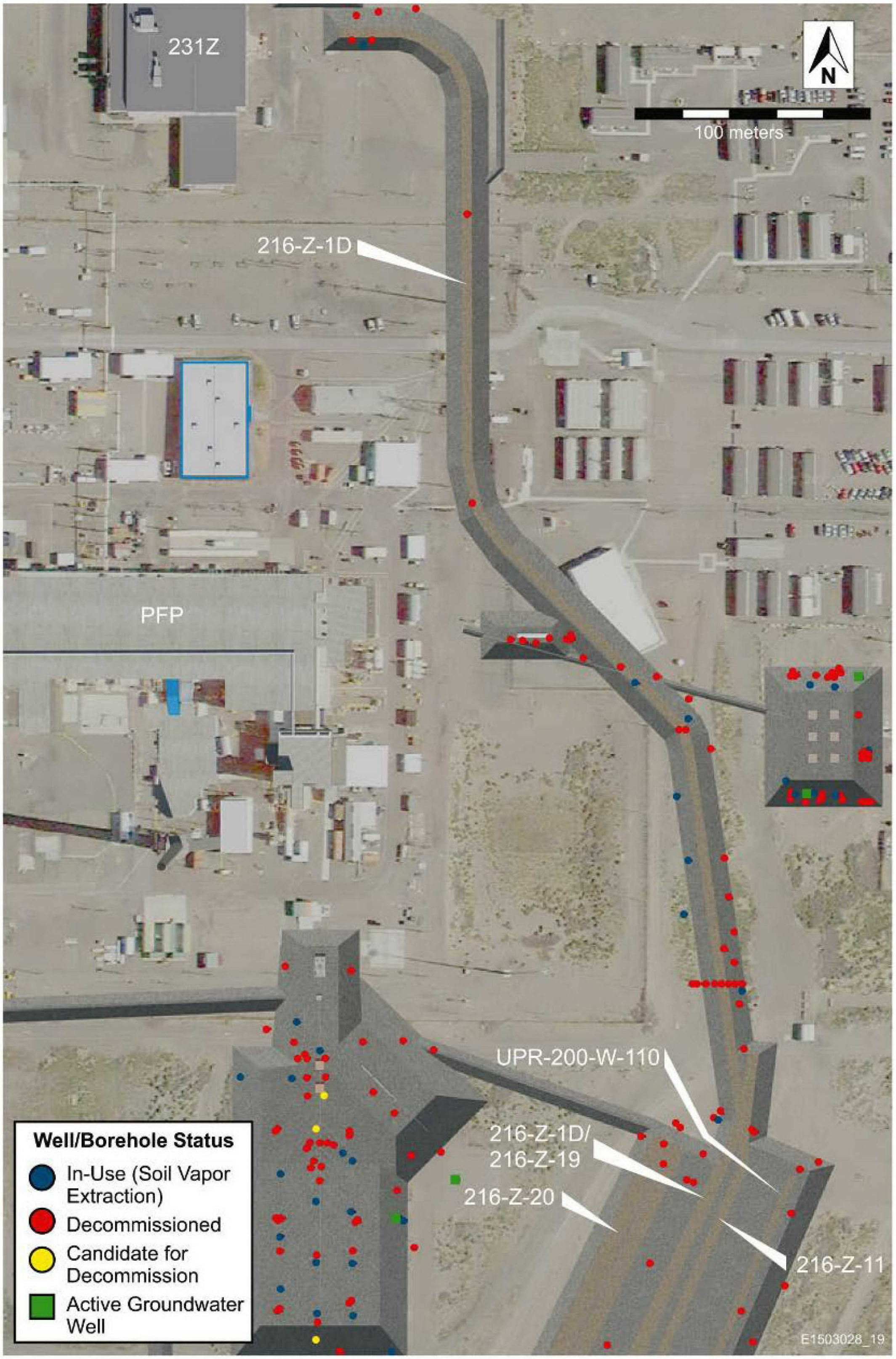

Figure A-2. Excavated View of North End of Z Ditches with Wells and Boreholes

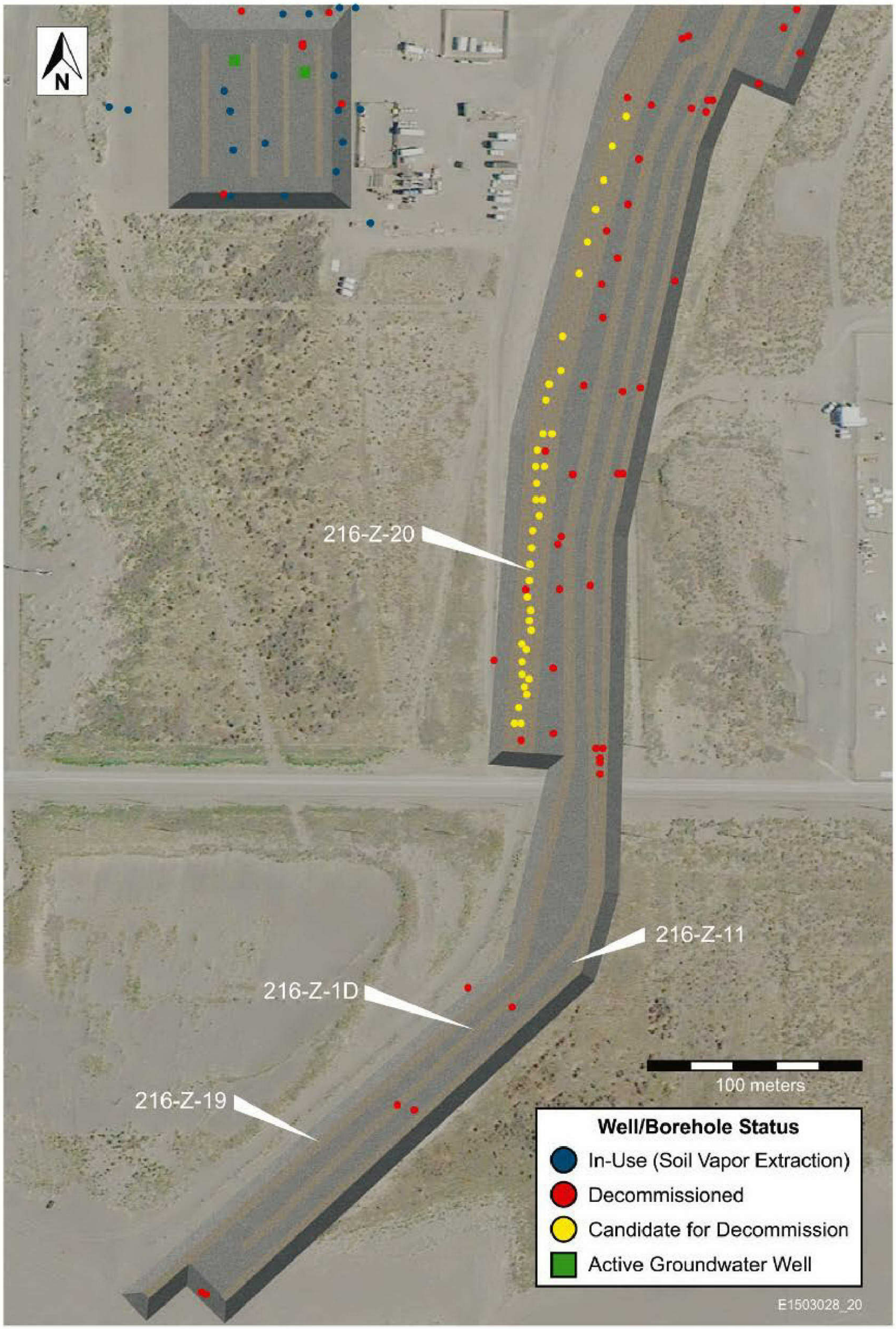

Figure A-3. Excavated View of South End of Z Ditches with Wells and Boreholes

Although radionuclide inventory estimates exist, because of the uncertain nature of the results arrived at using waste stream chemistry methods and the absence of available inventory information for periods of time when the ditch streams were not monitored, the soil sampling data provide a more reliable indication of the nature and extent of Z Ditch contamination. Table A-1 shows the maximum contaminant concentrations detected in subsurface soil samples obtained from the 200-CW-5 OU waste sites.

The collective Z Ditches area was deactivated and stabilized in 1981 following construction of the 216-Z-20 Tile Field as the primary Z Plant wastewater disposal facility. The concrete headwalls, vegetation, and miscellaneous unsalvageable equipment were disposed of into the 216-Z-19 Ditch bottom. At this time, the previously buried 216-Z-1D and 216-Z-11 Ditches received an additional 0.15 to 0.3 m (0.5 to 1 ft) of clean fill.

Table A-1. Maximum Contaminant Concentrations in 200-CW-5 OU Waste Sites

Contaminant	Maximum Concentration	Sample Location	Sample Date	Sample Depth (m bgs)[a]
Radionuclides				
Cesium-137	66,000 pCi/g[b]	216-Z-19 Ditch	1976	2.1
Americium-241	7,870,000 pCi/g[c]	216-Z-19 Ditch	1976	2.1
Strontium-90	216 pCi/g	216-Z-19 Ditch	1976	2.1
Plutonium-238	5,500 pCi/g	216-Z-19 Ditch	1979	1.8 to 2.1
Plutonium-239	780,000 pCi/g	216-Z-1D Ditch	1959	2.4
Plutonium-239/240	13,000,000 pCi/g	216-Z-19 Ditch	1979	1.2
Thorium-230	8.4 pCi/g	216-Z-11 Ditch	2002	3 to 3.8
Radium-226	5,200 pCi/g	216-Z-19 Ditch	1976	2.1
Nonradionuclides[d]				
Nitrite	43 mg/kg	216-Z-11 Ditch	2002	3 to 4.6
Total Petroleum Hydrocarbon	27 mg/kg	216-Z-11 Ditch	2002	3 to 3.8
Aroclor 1254[e]	52 mg/kg	216-Z-11 Ditch	2002	2.3 to 3
Aroclor 1260[e]	78 mg/kg	216-Z-11 Ditch	2002	2.3 to 3
Boron	24 mg/kg	216-Z-11 Ditch	2002	2.3 to 3

a. Sample depths shown are depths bgs at the time of sampling. Contamination is now 1 to 0.6 m (3.3 to 2 ft) deeper at locations sampled before 1981 due to addition of stabilization material.

b. Decayed value for cesium-137 was used from 2003 (DOE/RL-2003-11, Remedial Investigation for the 200-CW-5 U Pond/Z Ditches Cooling Water Group, the 200-CW-2 S Pond and Ditches Cooling Water Group, the 200-CW-4 T Pond and Ditches Cooling Water Group, and the 200-SC-1 Steam Condensate Group Operable Units). Cesium-137 has a half-life of only 30 years, and decayed value was used because concentrations have diminished significantly since sample collection.

c. The americium value shown is the value measured at the time of sample analysis and does not reflect radioactivity decay or in-growth of plutonium-241 since then.

d. All nonradiological soil sample results from 2002 remedial investigation sampling of Borehole C3808.

e. Aroclor is an expired trademark.

bgs = below ground surface

The following subsections of this appendix provide brief descriptions of the 200-CW-5 OU waste sites addressed in the remedial design/remedial action work plan (RD/RAWP).

A1.1.1 216-Z-1D Ditch

The 216-Z-1D Ditch operated from 1944 to 1959. It was 1,295 m (4,249 ft) long and 0.6 m (2 ft) deep, with a bottom width of 1.2 m (4 ft) (WHC-EP-0707, *216-U-10 Pond and 216-Z-19 Ditch Characterization Studies*). Originally, the ditch flowed from a headwall located approximately 60 m (196 ft) east of the 231-Z Plutonium Isolation Plant. In 1949, after approximately 4 years of operations and as part of the 234-5Z Facility construction, the north 526 m (1,725 ft) section of this ditch was abandoned, backfilled, and replaced with process sewer piping that was routed around the 234-5Z Facility security fencing. A new headwall was constructed approximately 457 m (1,500 ft) downstream, where the new pipeline emptied into the remaining south portion of the ditch. The south portion continued to operate until 1959 and had the potential to receive cooling water waste containing constituents associated with the additional processes that occurred at the 231-Z Facility after 1949.

The north portion of the 216-Z-1D Ditch reportedly did not contain significant contamination when it was abandoned in 1949 and, according to data gathered in 1981, is significantly less contaminated than the south portion of the 216-Z-1D Ditch. The coil failures that were a major source of cooling water waste stream contamination in later years had not yet developed, and no reports of process-upset discharges have been identified. Open ditches were routinely surveyed for radiological contamination to control the potential spread of windblown contamination.

A1.1.2 216-Z-11 Ditch

The 216-Z-11 Ditch operated from 1959 to 1971 and was constructed to replace the 216-Z-1D Ditch after high plutonium contamination was discovered in the portion below the new headwall. As with the other Z Ditches, it is presumed that the 216-Z-11 Ditch was retired due to evidence of unacceptable levels of surface contamination obtained during operations. The 216-Z-11 Ditch was excavated immediately east of and parallel to the south portion of the 216-Z-1D Ditch and was of similar length (approximately 797 m [2,615 ft] long), width (1.2 m [4 ft] at the bottom), and depth (0.6 m [2 ft] deep). Material excavated for 216-Z-11 Ditch construction was used to backfill the 216-Z-1D Ditch to grade.

A1.1.3 216-Z-19 Ditch

In April 1971, the 216-Z-11 Ditch was retired and replaced with the 216-Z-19 Ditch. The 216-Z-19 Ditch was dug west of and parallel to the 216-Z-1D and 216-Z-11 Ditches and operated from 1971 to 1981. Excavation material from the 216-Z-19 Ditch was used to backfill the 216-Z-11 Ditch to grade. The 216-Z-19 Ditch was similar to that of the previous ditches, except that it was 1.2 m (4 ft) deep (DOE/RL-91-58, *Z Plant Source Aggregate Area Management Study Report*).

In 1971, during construction of the 216-Z-19 Ditch, contaminated sediments approximately 130 m (427 ft) from the 216-Z-1D Ditch were inadvertently excavated. Consequently, this portion of the ditch was shifted approximately 10.6 m (35 ft) west. The contaminated sediments were reburied in a trench dug parallel to and east of the 216-Z-11 Ditch, currently designated UPR-200-W-110.

A temporary alignment resulted in the 216-Z-19 Ditch reentering the existing 216-Z-11 Ditch to use the only culvert beneath 16th Street. In October 1971, a new culvert was installed 15 m (49 ft) to the west, and the 216-Z-19 Ditch was realigned and continued approximately 305 m (1,000 ft) to the 216-U-10 Pond.

In late March 1976, an accidental release of contamination occurred in the 216-Z-19 Ditch, and efforts were made to contain the contaminants in the ditch. A series of three earthen dams was constructed, at intervals along the portion of the ditch above 16th Street, to raise the ditch water level above the original contaminated water line and stop contaminated wastewater from reaching the 216-U-10 Pond. A water sprinkler system was installed between the lowermost dam and the 216-U-10 Pond to control the spread of windblown contamination by preventing this portion of the ditch from drying out. Thereafter, wastewater never reached the pond. In March 1978, the sprinklers were shut down and the dams were removed, but the remaining surface water infiltrated the soil column before reaching the 216-U-10 Pond. Consequently, from 1976 until 1981, when the 216-Z-19 Ditch ceased receiving effluent, waste stream contaminants were disposed to the soil column. Wastewater was diverted from the 216-Z-19 Ditch to the 216-Z-20 Tile Field shortly afterward.

A1.1.4 216-Z-20 Tile Field

The 216-Z-20 Tile Field operated from 1981 to 1995. It was used to dispose of effluent similar to that previously routed via the ditches to the 216-U-10 Pond. The 216-Z-20 Tile Field is an unlined subsurface disposal site that is 463 by 3 m (1,519 by 10 ft) at the base of the unit with a depth of 2.9 m (9.5 ft). Three perforated polyvinyl chloride pipes run the length of the ditch in a bed of gravel that was backfilled with clean gravel and soil. The 216-Z-20 Tile Field received cooling water, steam condensate, storm sewer runoff, and/or building and chemical drain waste from Z Plant, 231-Z Facility, 291-Z Facility, 232-Z Waste Incinerator Facility, 236-Z Plutonium Reclamation Facility (PRF), and 2736-Z Plutonium Storage Building. The site received an effluent volume of 3.8 billion L (1 billion gal).

Deactivation and stabilization of the Z Ditches area began in 1981, following construction of the 216-Z-20 Tile Field as the primary Z Plant wastewater disposal facility. Woody vegetation in the 216-Z-19 Ditch was killed with herbicides (glyphosate and dicamba) before backfill operations were initiated. The 216-Z-19 Ditch was covered with 0.6 to 1 m (2 to 3 ft) of clean soil. The concrete headwalls, vegetation, and miscellaneous unsalvageable equipment were incorporated into the ditch bottom. At the same time, the previously buried 216-Z-1D and 216-Z-11 Ditches received an additional 0.15 to 0.30 m (0.5 to 1.0 ft) of clean fill. The Z Ditch area likely has 0.30 to 0.6 m (1 to 2 ft) of accumulated stabilizing soil cover over the ditch backfill material.

A1.1.5 UPR-200-W-110

UPR-200-W-110 is a narrow, one-time-use disposal trench located immediately east of and parallel to the 216-Z-11 Ditch. This trench was used to dispose of spoils containing contaminated 216-Z-1D Ditch sediments material inadvertently excavated from the 216-Z-1D Ditch during 216-Z-19 Ditch construction in 1971. The trench is 129.5 m (425 ft) long and 4.6 m (15 ft) deep. The bottom 2 m (7 ft) of the trench was filled with the contaminated spoils material and filled to grade with clean backfill. Consequently, this site contains similar waste constituents as the other Z Ditches. No inventory is reported for this site.

A1.2 200-PW-1 Operable Unit

From the time the Z Plant complex came online in 1949, it generated large volumes of waste effluent. Until 1990, effluents such as cooling water that, under normal operating conditions, contained little or no radiological contamination were discharged to the Z Ditches that drained to the U Pond.

From 1949 until May 1973, effluents from chemical processes and plutonium finishing activities that, under normal operating conditions, contained low levels of plutonium and other contaminants were discharged to the soil column at subsurface engineered waste sites. These engineered waste sites were designed to provide effective disposal of effluent to the soil column and were operated in a manner intended to limit adverse impacts to groundwater. Six subsurface engineered waste sites and an associated subsurface settling tank that received these contaminated process waste streams comprise the 200-PW-1 OU. Figure A-4 shows the location of the 200-PW-1 OU waste sites in the 200 West Area.

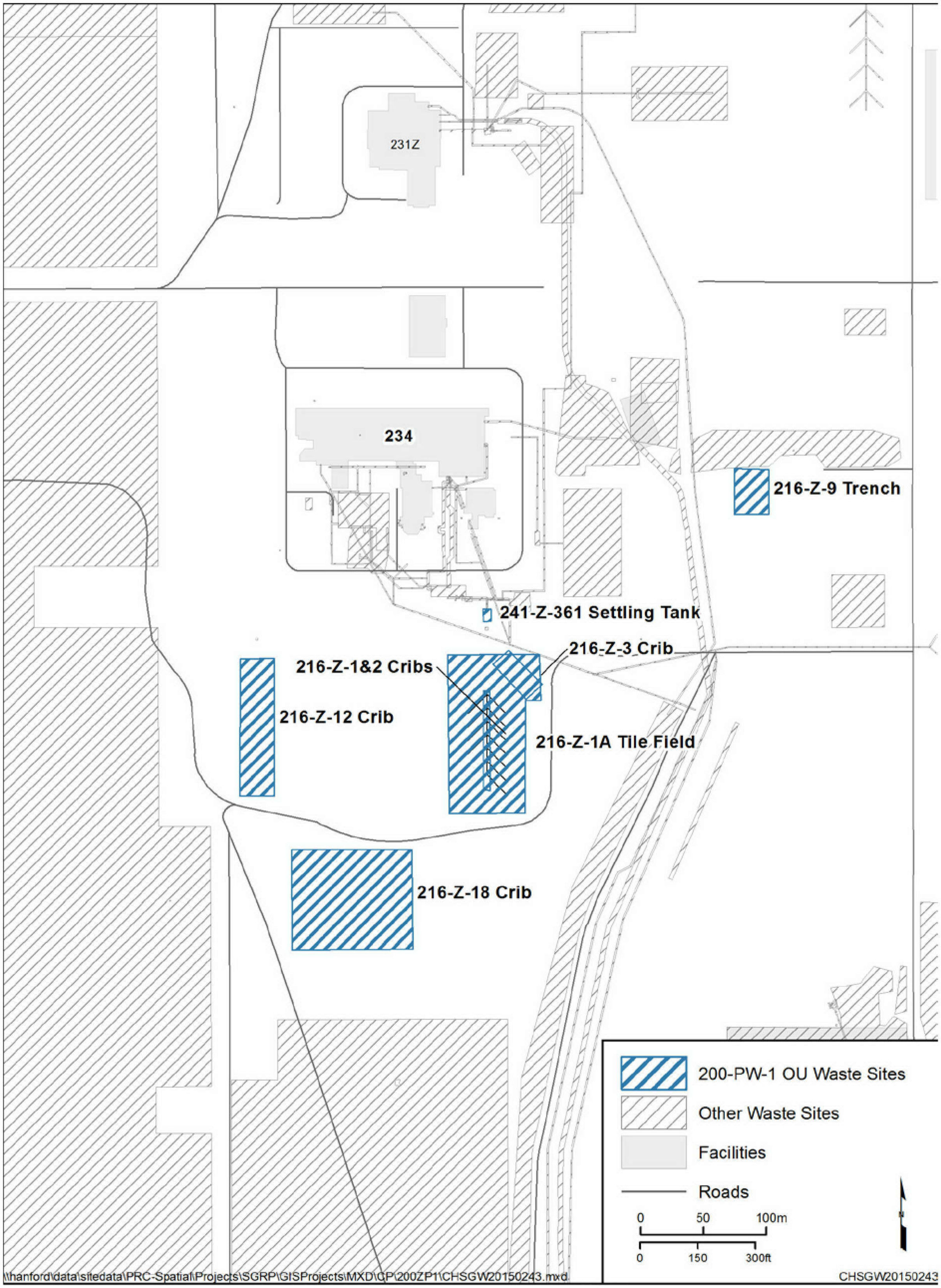

Figure A-4. Location of the 200-PW-1 OU Waste Sites

Three of the 200-PW-1 waste sites (216-Z-9 Trench, 216-Z-1A Tile Field, and 216-Z-18 Crib) primarily received waste streams from the Recovery of Uranium and Plutonium by Extraction (RECUPLEX) or the PRF solvent extraction systems. These waste streams included acidic aqueous-phase process wastes containing plutonium and americium. This aqueous waste, referred to as High-Salt waste, was a concentrated nitrate solution containing dissolved metal (aluminum, calcium, sodium, magnesium) nitrates. These three sites also received significant volumes of organic wastes (principally carbon tetrachloride, tributyl phosphate [TBP], and lard oil), both entrained in the aqueous-phase waste streams and as separate, nonaqueous-phase waste streams. These three sites were operated sequentially, starting with the 216-Z-9 Trench, and replaced when conditions warranted. Table A-2 shows the operating history and primary waste streams for these waste sites.

Table A-2. 216-Z-9 Trench, 216-Z-1A Tile Field, and 216-Z-18 Crib Waste Sites

Waste Site	Period of Operation	Primary Waste Stream
216-Z-9 Trench	1955 to 1962	Acidic High-Salt aqueous-phase wastes and organic nonaqueous-phase wastes, containing plutonium and americium
216-Z-1A Tile Field*	1964 to 1969	
216-Z-18 Crib	1969 to 1973	

* The 216-Z-1A Tile Field received neutral-to-basic aqueous-phase process and laboratory waste from 1949 to 1959 as overflow from the 216-Z-1 and 216-Z-3 Cribs.

The following sections of this appendix provide brief descriptions of the 200-PW-1 OU waste sites addressed in the RD/RAWP.

A1.2.1 216-Z-1A Tile Field

The 216-Z-1A Tile Field is located in the 200 West Area about 153 m (500 ft) south of the 234-5Z Building and immediately south of the 216-Z-1&2 Cribs and is adjacent to the 216-Z-3 Crib (Figure A-5). The surface elevation at the site is approximately 205 m (673 ft). The tile field piping is 20 cm (8 in.) diameter vitrified clay pipe placed on a 1.5 m (5 ft) deep gravel bed. The distributor pipe consists of a 79 m (260 ft) long north-south trunk or main pipeline with seven pairs of 21 m (70 ft) laterals spaced at 11 m (35 ft) intervals in a symmetrical herringbone pattern. The main pipeline is a continuous line without perforations. The laterals are divided into 0.3 m (11 in.) long segments. The piping system was overlaid with 15 cm (6 in.) of cobbles and 1.5 m (5 ft) of sand and gravel.

From 1949 to 1959, the waste streams discharged to the adjacent 216-Z-1&2 Cribs (1949 to 1952), and the 216-Z-3 Crib (1952 to 1959) overflowed to the 216-Z-1A Tile Field. The waste stream consisted of neutral-to-basic (pH 8 to 10) process waste and analytical and development laboratory waste from Z Plant via the 241-Z-361 Settling Tank. The total volume of waste estimated to have overflowed to the 216-Z-1A Tile Field from 1949 to 1959 was approximately 1 million L (0.26 Mgal).

The 216-Z-1A Tile Field initially was taken out of service in March 1959 after low concentrations of plutonium were detected in the soil at the bottom of a well near the 216-Z-3 Crib. The 216-Z-1A Tile Field was receiving overflow from the 216-Z-3 Crib during this time and was taken out of service when the 216-Z-3 Crib was replaced.

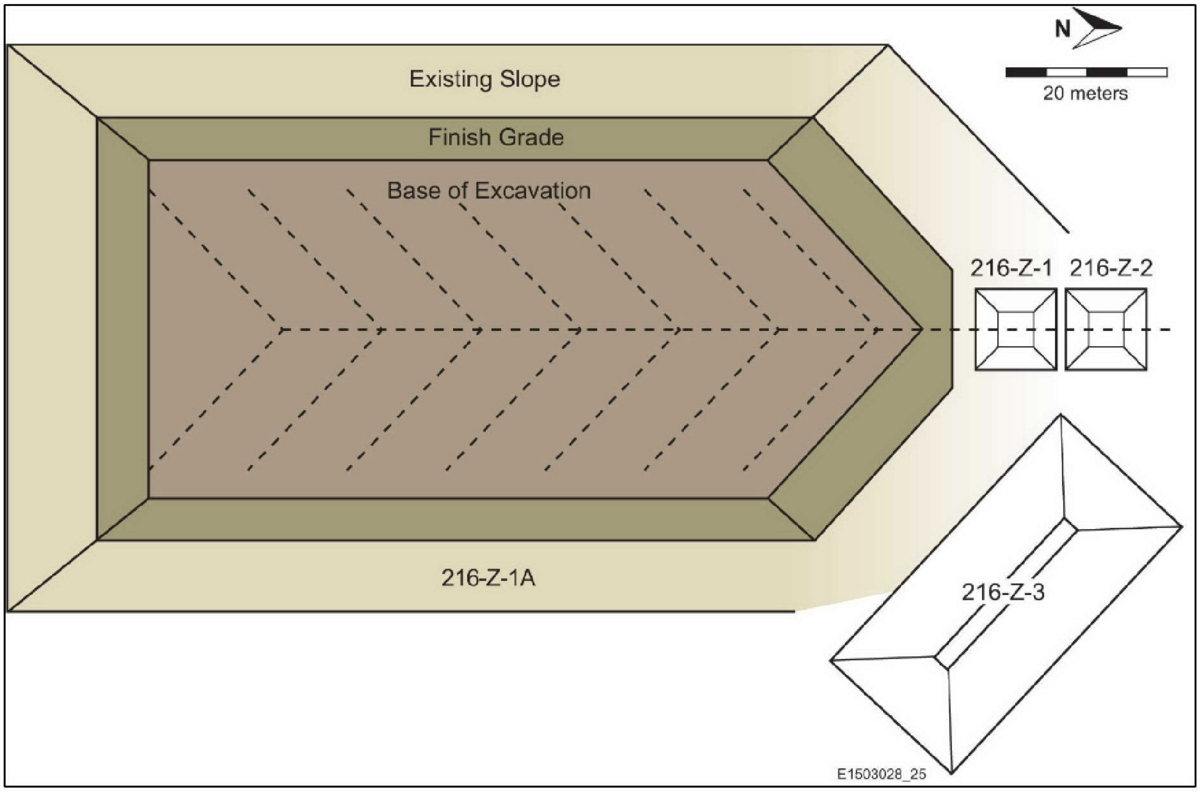

Figure A-5. 216-Z-1A, 216-Z-1, 216-Z-2, and 216-Z-3 Plot Plan

In 1964, the 216-Z-1A Tile Field was reactivated to receive plutonium reclamation operation waste liquids directly. The 216-Z-1A Tile Field was recommended for use, replacing the 216-Z-9 Trench. Before the 216-Z-1A Tile Field was reactivated in 1964, a sheet of 0.05 cm (0.02 in.) thick polyethylene and a 30 cm (1 ft) thick layer of sand and gravel were added, and the liquid waste discharge piping was routed directly to the central distributor pipe in the tile field. Between 1964 and 1969, a 5 cm (2 in.) diameter stainless steel pipe was progressively inserted inside the central distributor pipe to divide the tile field into three operational sections: 216-Z-1AA, 216-Z-1AB, and 216-Z-1AC (RHO-LD-114, *Existing Data on the 216-Z Liquid Waste Sites*).

From 1964 to 1969, the 216-Z-1A Tile Field received approximately 5.2 million L (1.37 Mgal) of liquid waste from Z Plant, the 236-Z Facility, the 242-Z Waste Treatment and Americium Recovery Facility, and miscellaneous laboratory waste. Material discharged to the tile field reportedly included 57 kg (126 lb) of plutonium, 1 kg (2.2 lb) of americium-241, 270,000 kg (594,000 lb) of carbon tetrachloride, and 3,000 kg (6,600 lb) of nitrate. Carbon tetrachloride was discharged to the 216-Z-1A Tile Field in combination with other organics, as a small entrained fraction of process aqueous wastes and as dense, nonaqueous-phase liquid (DNAPL). The tile field was taken out of service in 1969 when it had received the prescribed liquid waste volume (ARH-2155, *Radioactive Liquid Waste Disposal Facilities - 200 West Area*).

A1.2.2 216-Z-1&2 Cribs

The 216-Z-1&2 Cribs are located in the 200 West Area, south of the 234-5Z Building, immediately north of the 216-Z-1A Tile Field and west of the 216-Z-3 Crib (Figure A-5). The 216-Z-1&2 Cribs are separate cribs but operated as one unit. The flow from the 216-Z-2 Crib overflowed into the 216-Z-1 Crib as part of normal operations. The surface elevation at the site is approximately 207.2 m (679.8 ft).

The 216-Z-1&2 Cribs are open-bottom, 3.7 m (12 ft) square, 4.3 m (14 ft) tall wooden boxes constructed in an excavation that was 4.3 m (14 ft) square at the bottom and 6.4 m (21 ft) deep. To control the intrusion of sand into the structure, open joints in the sides and top were caulked, and the upper half of the structure was lagged with 1.9 cm (0.75 in.) plywood. The two cribs, approximately 5.5 m (18 ft) apart, were connected and fed by a 20 cm (8 in.) diameter stainless steel central pipe with an outlet pipe to the 216-Z-1A Tile Field. The 216-Z-2 Crib overflowed into the 216-Z-1 Crib, which overflowed into the 216-Z-1A Tile Field. Two risers are visible from the surface of each crib. One is a filtered vent, and the other is the stickup for a test well (now decommissioned). The 20 cm (8 in.) steel test wells were centered within each crib, installed as part of the original construction. Each extended 6.1 m (20 ft) beyond the base of the timber structure to a total depth of 12.5 m (41 ft) below ground surface (bgs).

The 216-Z-1&2 Cribs operated from 1949 to 1969. From 1949 to 1952, the two cribs received Plutonium Finishing Plant (PFP) Low-Salt waste consisting of neutral-to-basic (pH 8 to 10) process waste and analytical and development laboratory waste from the 234-5Z Building via the 241-Z-361 Settling Tank. The 216-Z-1&2 Cribs were taken out of service in 1952 because the effluent flow rate to the cribs exceeded the infiltration capacity of the cribs, which then overflowed into the 216-Z-1A Tile Field. This Low-Salt waste stream was then discharged to the 216-Z-3 Crib, which replaced the 216-Z-1&2 Cribs, from 1952 to 1959, and finally to the 216-Z-12 Crib, which replaced the 216-Z-3 Crib, from 1959 to 1973.

The cribs were used for two brief periods in 1966 and 1967 during work on the central distributor pipe in the 216-Z-1A Tile Field. These periods of service were only intended to be for the duration of the 216-Z-1A Pipeline maintenance. During these two periods, the cribs received very small quantities of High-Salt waste directly from the PRF in the 236-Z PRF and the 242-Z Waste Treatment and Americium Recovery Facility. Significant volumes of organics likely were not discharged to these cribs during these short periods.

From 1968 to 1969, the cribs received uranium wastes directly from the 236-Z Building. Use of the cribs to receive uranium waste was concluded in 1969, when the discharge of uranium waste was discontinued. The cribs were administratively retired in 1969 and physically isolated when the inlet piping was cut and blanked.

In total, the two cribs received approximately 33,700,000 L (8,902,600 gal) of effluent: 33,500,000 L (8,849,760 gal) between 1949 and 1952 (Low-Salt wastes); 104,000 L (27,470 gal) between 1966 and 1967 (High-Salt wastes); and 98,000 L (25,890 gal) between 1968 and 1969 (Low-Salt wastes). An estimate of the discharged inventory includes 7 kg (15 lb) of plutonium and 100,000 kg (220,000 lb) of nitrate.

A1.2.3 216-Z-3 Crib

The 216-Z-3 Crib is located in the 200 West Area, south of the 234-5Z Building, immediately northeast of the 216-Z-1A Tile Field and adjacent to the 216-Z-1&2 Cribs (Figure A-5). The surface elevation at the site is approximately 207.2 m (679.8 ft). The waste distribution system at the 216-Z-3 Crib consists of three corrugated metal culvert sections (6.7 m [22 ft] long, 1.2 m [4 ft] in diameter) laid horizontally, end-to-end, within a gravel-filled excavation. Each culvert section was perforated with 2.5 cm (1 in.) diameter holes. The culvert sections were placed end-to-end, but it is not clear whether they were physically attached. Wire mesh was welded to both ends of the culvert to limit gravel intrusion. The base of the culverts is about 4.5 m (15 ft) below grade.

Excavation for the 216-Z-3 Crib was 7.6 m (25 ft) deep and, at its base, 1.5 m (5 ft) wide and 21.3 m (70 ft) long. At the base of the excavation, a clam bucket was used to dig two additional holes to a total depth of 13.7 m (45 ft) bgs to allow installation of two 20 cm (8 in.) diameter test wells (now decommissioned). On placement of the test well casings, the two holes were backfilled with sand up to the base of the excavation. Gravel was used to fill the excavation to within 2.4 m (8 ft) of the ground surface. The culvert sections and associated waste feed and overflow lines (20 cm [8 in.] vitrified clay pipe) were incorporated within the gravel. The base of the culverts is 4.5 m (15 ft) below grade, roughly 2.1 m (7 ft) below the top of the gravel. The gravel was covered with two layers of asphalt roofing paper, and the trench was backfilled to grade with clean fill. A 1.2 m (4 ft) wide, 1.8 m (6 ft) long, and 10 cm (4 in.) thick concrete slab with penetrating risers is centered over the culvert.

The 216-Z-3 Crib received PFP liquid effluent from 1952 to 1959. The effluent, a Low-Salt waste stream, was neutral-to-basic (pH 8 to 10) and included process waste as well as analytical and development laboratory wastes. Effluent was routed through a chemical sewer line from the 234-5Z Facility to the 241-Z-361 Settling Tank and distributed through Pipeline 200-W-210-PL to the western end of the 216-Z-3 Crib. Overflow from the crib went to the 216-Z-1A Tile Field.

The 216-Z-3 Crib was taken out of service in March 1959 after low concentrations of plutonium were detected in 1958 in the soil at the bottom of a well near the crib. There was concern that the soil column retention capacity had been or soon would be exhausted and plutonium might reach groundwater. The 216-Z-3 Crib was taken out of service when the replacement crib (216-Z-12) was placed into service.

The 216-Z-3 Crib received approximately 178,000,000 L (46,992,000 gal) of Low-Salt waste. An estimate of the discharged inventory includes 5.7 kg (12.6 lb) of plutonium and 600,000 kg (1,320,000 lb) of nitrate.

A1.2.4 216-Z-9 Trench

The 216-Z-9 Trench is about 213 m (700 ft) east of the 234-5Z Building in the 200 West Area of the Hanford Site. The surface elevation at the site is approximately 202 m (664 ft). The 216-Z-9 Trench consists of a 6.1 m (20 ft) deep open excavation with a 36.5 by 27.4 m (120 by 90 ft) concrete cover. The walls of the trench slope inward and downward to the 18 by 9 m (60 by 30 ft) floor space, which has a slight slope to the south. The underside of the concrete cover was paved with acid resistant brick/tiles. The cover of the trench is supported by six concrete columns. More than 4 million L (1 Mgal) of plutonium/organic-rich process waste was discharged to the trench between 1955 and 1962. The 216-Z-9 Trench is depicted in Figure A-6.

When the 216-Z-9 Trench was retired in 1962, it had received approximately 50 to 150 kg (110 to 330 lb) of plutonium. Mining took place at the 216-Z-9 Trench in 1976 and 1977 to remove plutonium. The upper 0.3 m (1 ft) of soil was removed from the floor of the trench. The mining operation removed an estimated 58 kg (128 lb) of plutonium. Based on data acquired during the mining operation, an estimated 38 to 48 kg (84 to 106 lb) of plutonium remains in the 216-Z-9 Trench (RHO-ST-21, *Report On Plutonium Mining Activities At 216-Z-9 Enclosed Trench*). The 6.4 m (21 ft) deep open space beneath the concrete cover over the 216-Z-9 Trench remains void of soil and contains only the discarded mining equipment. Pictures of the 216-Z-9 Trench with mining equipment and the above-grade glove box used during previous waste removal operations are shown in Figures A-7 and A-8, respectively.

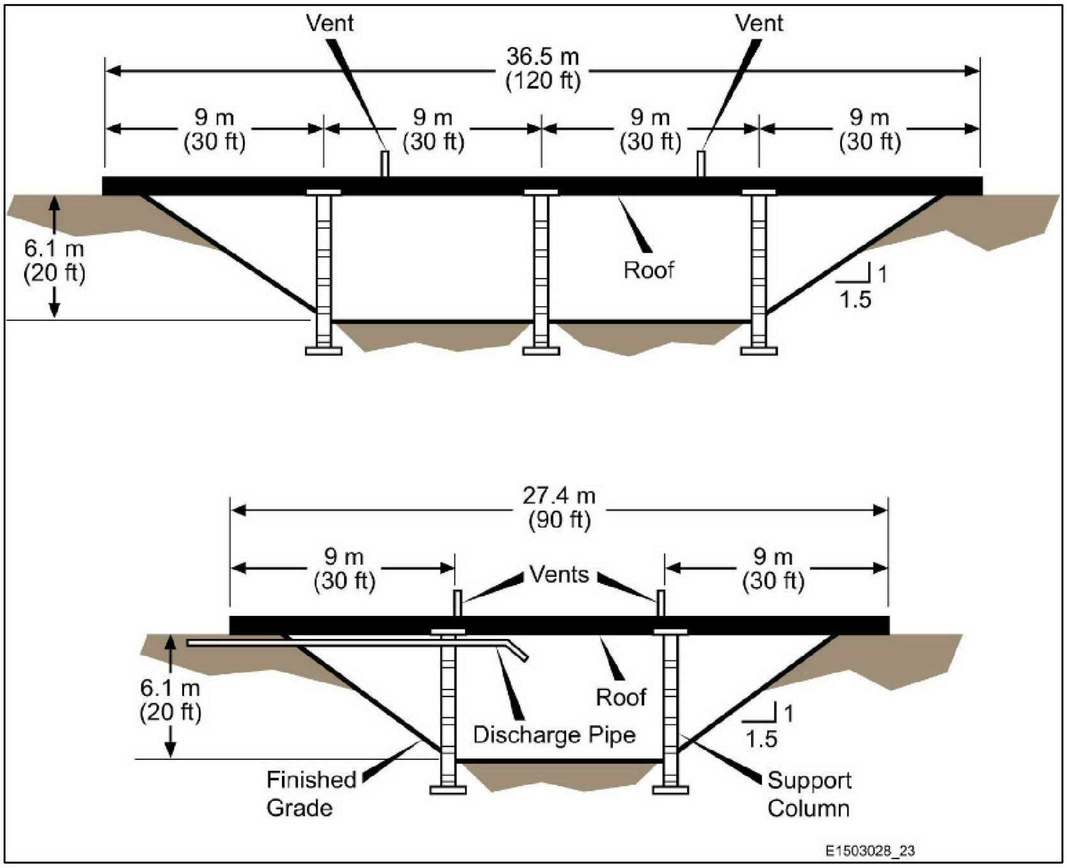

Figure A-6. 216-Z-9 Trench

Figure A-7. 216-Z-9 Trench Mining

Figure A-8. Glove Box at the 216-Z-9 Site

An excavated view of the 216-Z-9 Trench and nearby 241-Z-8 Settling Tank, including locations of wells and boreholes, is shown in Figure A-9. The plutonium contamination profile associated with the 216-Z-9 Trench is depicted in Figure A-10.

A1.2.5 216-Z-12 Crib

The 216-Z-12 Crib is located in the 200 West Area, southwest of the 234-5Z Building and northwest of the 216-Z-18 Crib. The surface elevation at the site is approximately 208.3 m (683.6 ft). The 216-Z-12 Crib is rectangular, 91 by 6 m (300 by 20 ft) at the bottom, and 5.8 m (19 ft) deep. Waste entered at 4.6 m (15 ft) bgs through a 30 cm (12 in.) diameter, perforated, vitrified clay pipe that ran the length of the crib and rested on a 1.5 m (5 ft) bed of gravel. The pipe was covered with a polyethylene barrier and backfilled to grade. In 1968, a 15 cm (6 in.) diameter steel bypass line was installed 9 m (30 ft) west of and parallel to the original distribution line to bypass 30.5 m (100 ft) of the original line that was plugged (Figure A-11).

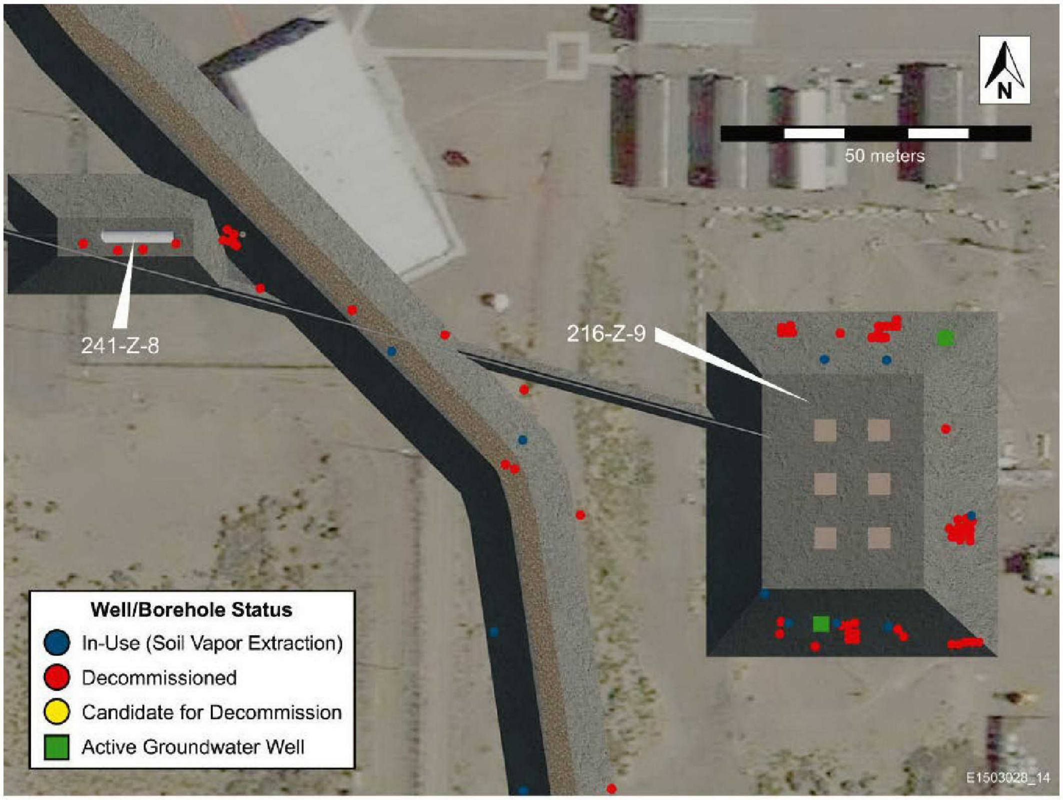

Figure A-9. Excavated View of the 216-Z-9 Trench and 216-Z-8 Settling Tank

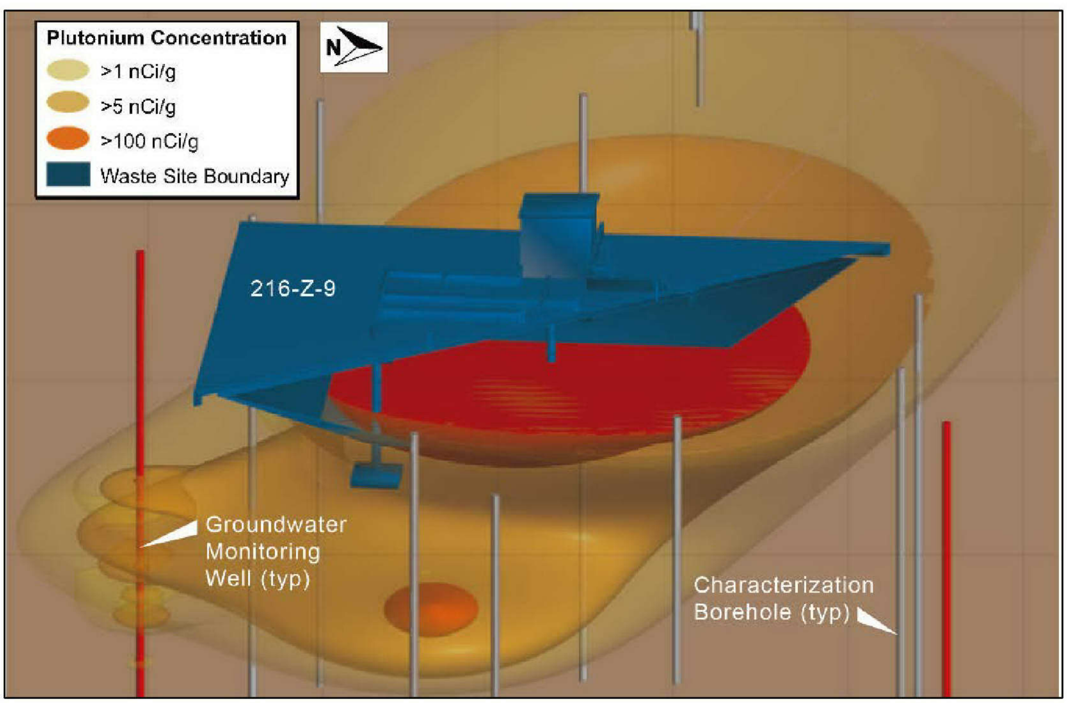

Figure A-10. Plutonium Plume at the 216-Z-9 Site

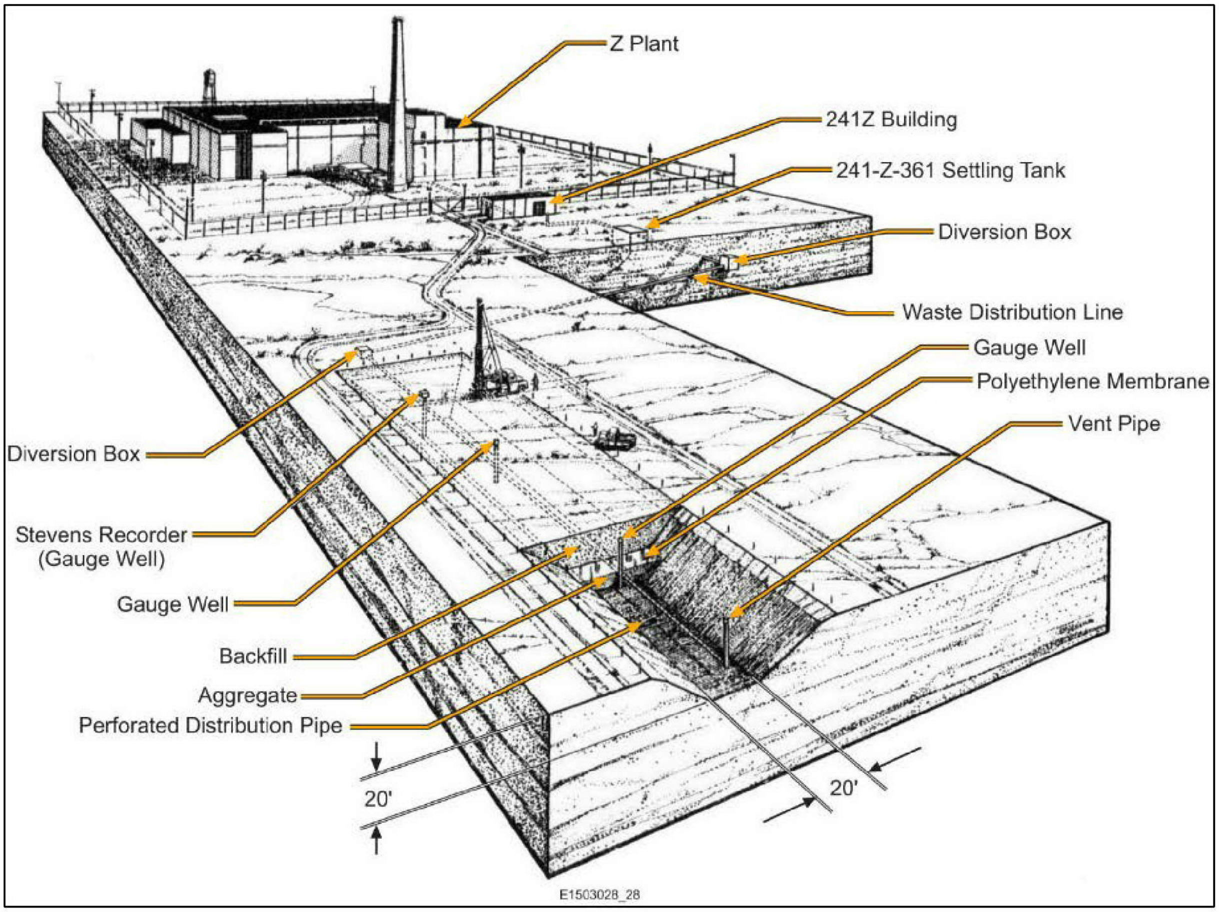

Figure A-11. 216-Z-12 Crib

The 216-Z-12 Crib is a subsurface liquid waste site that was used from 1959 to 1973, as a replacement for the 216-Z-3 Crib, to dispose of PFP liquid process waste and analytical and development laboratory waste from the 234-5Z Facility via the 241-Z-361 Settling Tank. The waste was Low-Salt and neutral-to-basic (pH 8 to 10) when discharged. In total, the 216-Z-12 Crib received approximately 281 million L (74.24 Mgal) of waste. Material discharged to the crib reportedly included 25.1 kg (55 lb) of plutonium and 900,000 kg (1,980,000 lb) of nitrate. The site likely received a small volume of organics (e.g., an organic-phase waste such as carbon tetrachloride).

The 216-Z-12 Crib was taken out of service in May 1973 when discharge of contaminated waste streams to the ground from PFP was discontinued as a matter of policy. It was deactivated by blanking the waste feed piping in the 241-Z Sump Facility. A portion of the crib was vitrified as part of an in situ vitrification test project conducted in June 1987. This resulted in a 408 metric ton (450 ton) block of vitrified soil extending down to 5 m (16 ft) bgs. An excavated view of the 216-Z-12 Crib with locations of wells, boreholes, and vitrified soil is shown in Figure A-12.

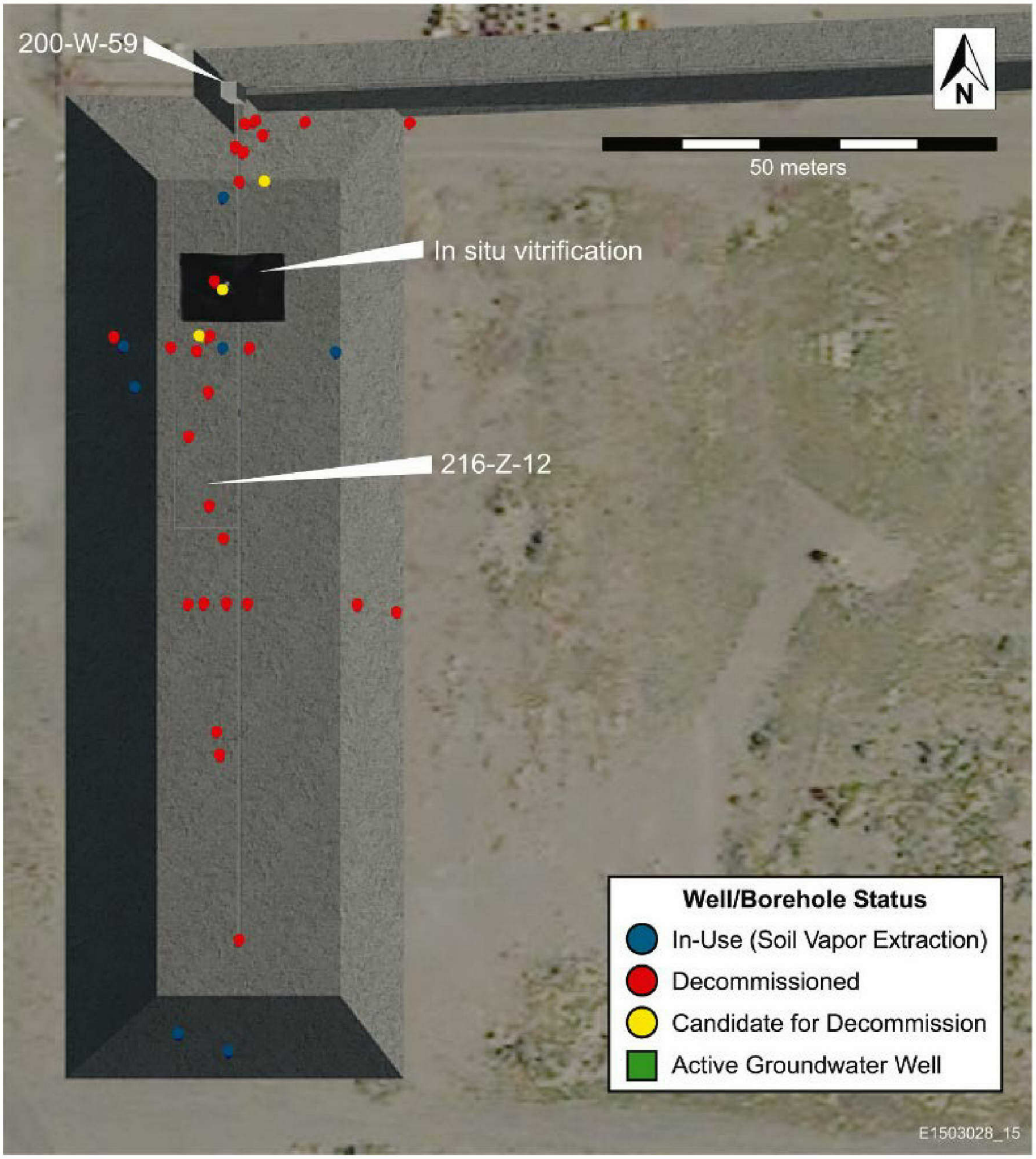

Figure A-12. Excavated View of 216-Z-12 Crib with Wells and Boreholes

A1.2.6 216-Z-18 Crib

The 216-Z-18 Crib is located in the 200 West Area, southwest of the 216-Z-1A Tile Field and southeast of the 216-Z-12 Crib. The surface elevation at the site is approximately 208.9 m (685.3 ft). The 216-Z-18 Crib is a below-grade inactive liquid waste management unit. The 95 by 79 m (311 by 259 ft) site consists of five separate, parallel, north-south-running trenches, each 63 by 3 m (207 by 10 ft), and approximately 5.5 m (18 ft) deep. Each crib structure has two 8 cm (3 in.) diameter distribution pipes placed on a 0.3 m (1 ft) thick bed of gravel at 5.2 m (17 ft) bgs, buried under an additional 0.3 m (1 ft) of gravel, covered with a membrane and sand, and backfilled to grade. The 216-Z-18 Crib is depicted in Figure A-13. A view of the crib during construction is shown in Figure A-14.

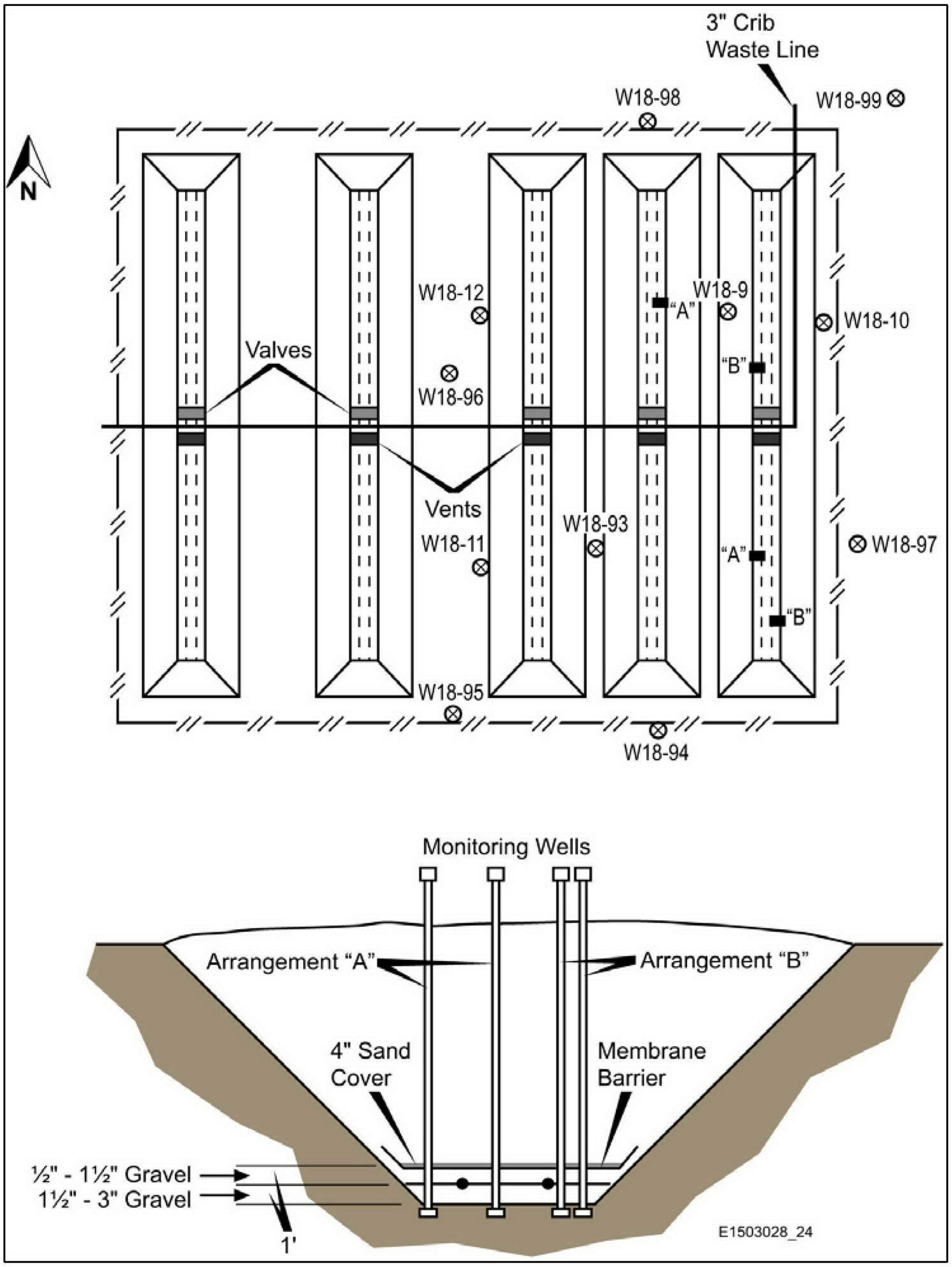

Figure A-13. 216-Z-18 Crib

Figure A-14. 216-Z-18 Crib Construction in 1968

Waste distributor piping in each trench was fed by the primary steel distribution pipe that bisected each trench. The crib was designed and operated as a specific retention facility. The 216-Z-18 Crib was used as a replacement for the 216-Z-1A Tile Field to receive High-Salt, acidic (pH 1 to 2.5), aqueous liquid waste and organic liquid waste. The waste streams included plutonium recovery waste from the 236-Z Facility and americium recovery waste from the 242-Z Waste Treatment and Americium Recovery Facility. Carbon tetrachloride was received in the aqueous-phase liquid and mixed with other organics as a DNAPL. The individual trenches were operated for approximately 1 year each. Trenches were active as follows: Trench 3 (1969 to 1970), Trench 2 (1970 to 1971), Trench 1 (1971 to 1972), and Trench 4 (1972 to 1973). Trench 5 was never used.

The 216-Z-18 Crib received a total of 3.86 million L (1.02 Mgal) of effluent. Material discharged to the crib reportedly included 23 kg (51 lb) of plutonium; 175,000 kg (386,000 lb) of carbon tetrachloride; and 500,000 kg (1,102,000 lb) of nitrate. Carbon tetrachloride was discharged to the 216-Z-18 Crib in combination with other organics, as a small entrained fraction of process aqueous wastes, and as DNAPL.

Soil vapor extraction (SVE) has been in operation at the 216-Z-18 Crib since 1992 as an interim action to remove carbon tetrachloride from the vadose zone soils. Between 1991 (when the SVE system pilot test was conducted at the 216-Z-1A Tile Field) and September 2008, the SVE system removed approximately 24,772 kg (54,613 lb) of carbon tetrachloride from the combined 216-Z-1A/216-Z-18/216-Z-12 Well Field (SGW-40456, *Performance Evaluation Report for Soil Vapor Extraction Operations at the 200-PW-1 Operable Unit Carbon Tetrachloride Site, Fiscal Year 2008*).

The 216-Z-18 Crib was taken out of service in May 1973 when discharge of contaminated waste streams to the ground from PFP was discontinued as a matter of policy (DOE/RL-91-32, *Expedited Response Action Proposal (EE/CA & EA) for 200 West Area Carbon Tetrachloride Plume*, Appendix A). It was deactivated by blanking pipelines in the 236-Z and 242-Z Buildings. An excavated view of the 216-Z-18 Crib, including locations of wells and boreholes, is shown in Figure A-15.

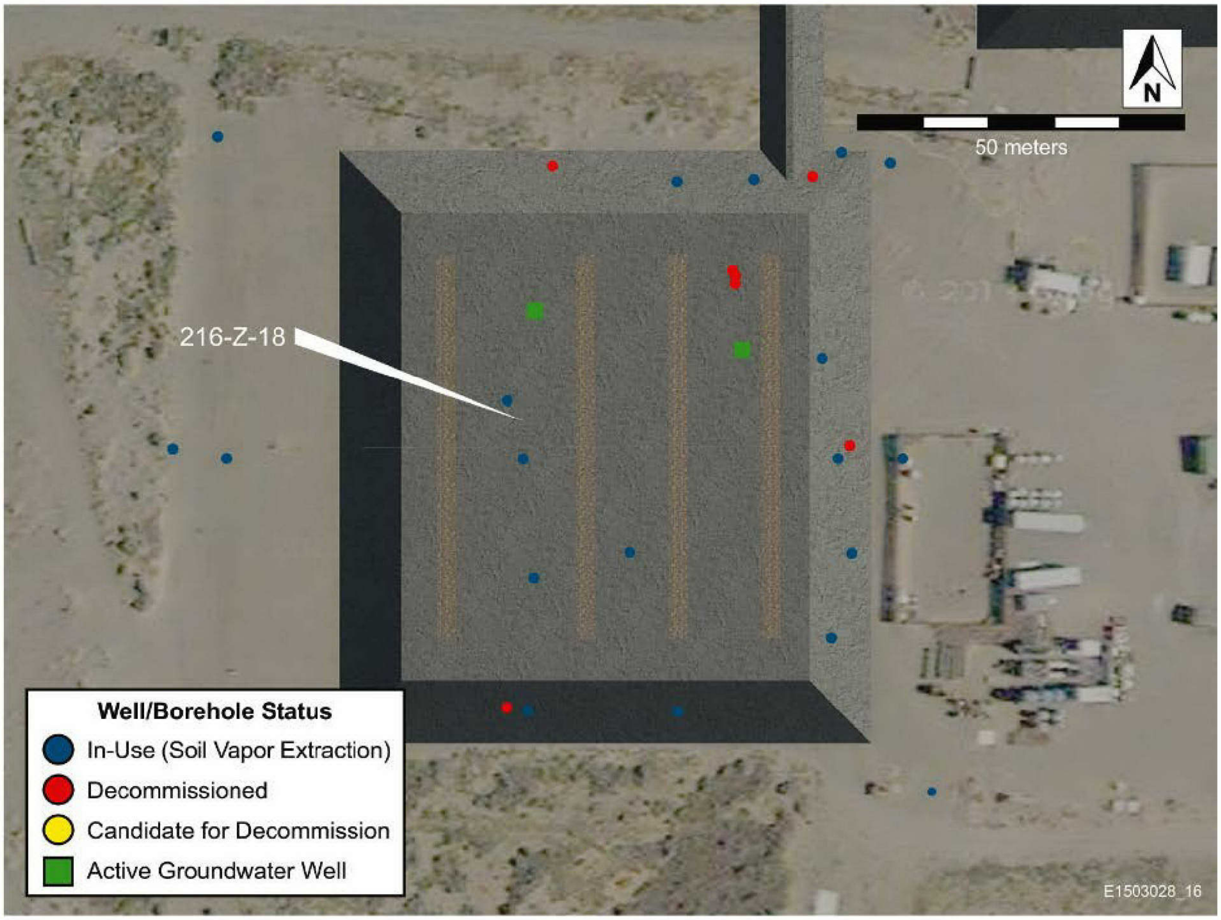

Figure A-15. Excavated View of 216-Z-18 Crib with Wells and Boreholes

A1.2.7 241-Z-361 Settling Tank

The 241-Z-361 Settling Tank is located approximately 35 m (115 ft) north of the 216-Z-1A Tile Field in the 200 West Area, within the boundary of the PFP Complex. The surface elevation at the site is approximately 207.2 m (679.8 ft). The surface elevation and hydrogeologic conditions at the 241-Z-361 Settling Tank site are the same as those for the adjacent 216-Z-1A Tile Field.

The 241-Z-361 Settling Tank is an underground, reinforced concrete structure 8.5 m (28 ft) long and 4.5 m (15 ft) wide, with a 1 cm (3/8 in.) thick steel liner. The tank has inside dimensions of 7.9 by 4 m (26 by 13 ft) with 0.3 m (1 ft) thick walls. The bottom slopes, resulting in an internal height variation between 5.2 and 5.5 m (17 and 18 ft). The top is 0.6 m (2 ft) below grade. One 15 cm (6 in.) diameter stainless steel inlet pipe from the 241-Z Facility enters the settling tank from the north. A second 15 cm (6 in) diameter carbon steel line from the 207-Z Retention Basin also entered the 241-Z-361 Settling Tank from the north but has been cut and plugged. A single 20 cm (8 in.) diameter stainless steel pipe exits the tank from the south. Several risers are visible above grade. The external configuration of the 241-Z-361 Settling Tank is depicted in Figure A-16.

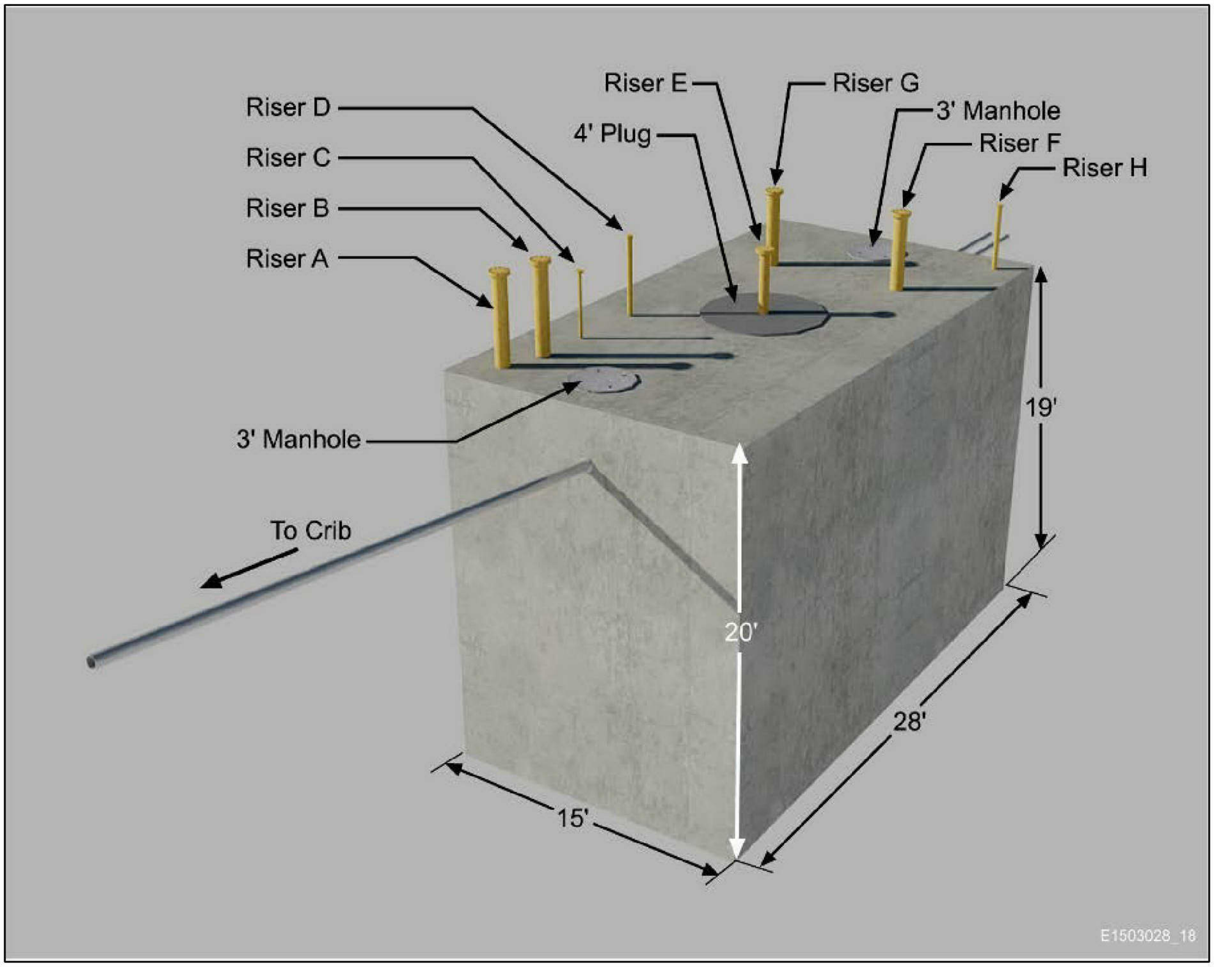

Figure A-16. 241-Z-361 Settling Tank Configuration

The tank served as the primary solids settling tank for Low-Salt liquid waste from the 234-5Z, 236-Z, and 242-Z Facilities from 1949 to 1973. Supernatant effluent in the tank was discharged to the 216-Z-1&2, 216-Z-3, and 216-Z-12 Cribs. Prior to discharge to the tank, the effluent was neutralized in the 241-Z sump tanks by adding fly ash, and later sodium hydroxide, to raise the pH to the 8 to 10 range. Liquid samples collected in March 1975, however, had a pH as low as 4. Before this characterization, it was assumed the pH was greater than 2, which renders the plutonium mostly insoluble. The 241-Z-361 Settling Tank was taken out of service in May 1973 when discharge of contaminated waste streams to the ground from PFP was discontinued.

A structural review of the 241-Z-361 Settling Tank was performed, based on a 1999 video inspection. The review identified effects on the tank's interior roof, including cracking indications, attributed to the tank atmosphere etching the cement paste off the lower surface of the roof slab. The video showed that the inner steel plate liner was dissolved or removed over most of the area exposed to the tank liquid contents and etching of the sidewall as seen by exposed aggregate. The images did not allow an estimation of the distance that this effect may extend into the wall thickness but indicates a potential loss in wall structural capability. An interior photo of the 241-Z-361 Settling Tank taken in 1975 is shown in Figure A-17.

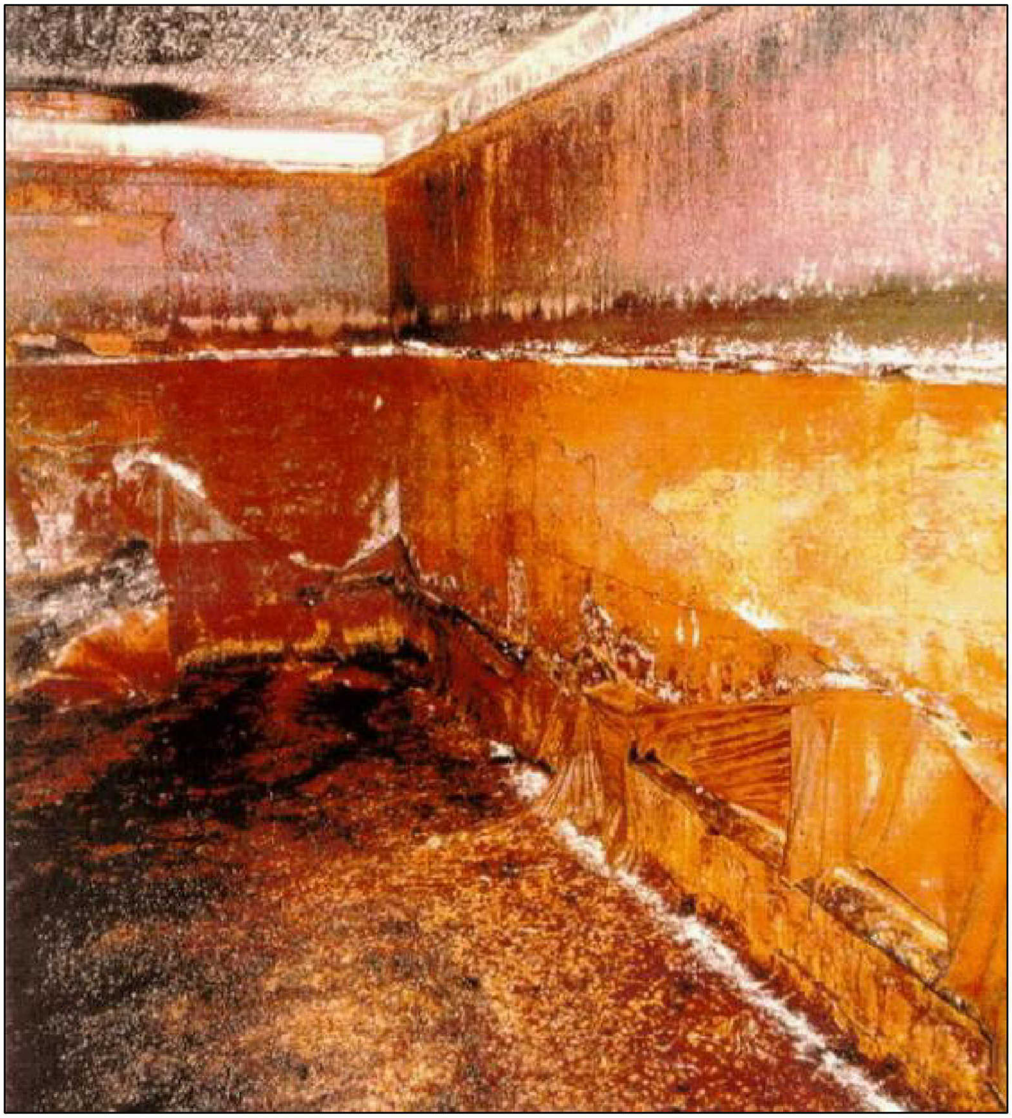

Figure A-17. Internal View of the 241-Z-361 Settling Tank

A1.3 200-PW-3 Operable Unit

The 200-PW-3 OU is located in the 200 East Area and consists of five waste sites: the 216-A-8 Crib, the 216-A-24 Crib, the 216-A-7 Crib, the 216-A-31 Crib, and a UPR site (UPR-200-E-56). Figure A-18 shows the location of the 200-PW-3 OU waste sites in the 200 East Area. The four cribs received effluent derived directly or indirectly from Plutonium Uranium Extraction (PUREX) operations. The 216-A-8 and 216-A-24 Cribs received vapor condensate from waste storage tanks in tank farms associated with PUREX. The 216-A-7 Crib received sump waste from a tank farm associated with PUREX and a one-time discharge of organic inventory, consisting of a hydrocarbon compound that may have contained TBP, from the PUREX chemical storage area. The 216-A-31 Crib received process waste from PUREX.

Waste streams discharged to these cribs contained fission products, primarily cesium-137, and both aqueous- and nonaqueous-phase organics. The principal organic constituents were refined kerosene (normal paraffin hydrocarbon [NPH]), TBP, and butanol. Wastes were discharged directly to the soil column. The UPR-200-E-56 site was contaminated by liquids migrating laterally from the 216-A-24 Crib.

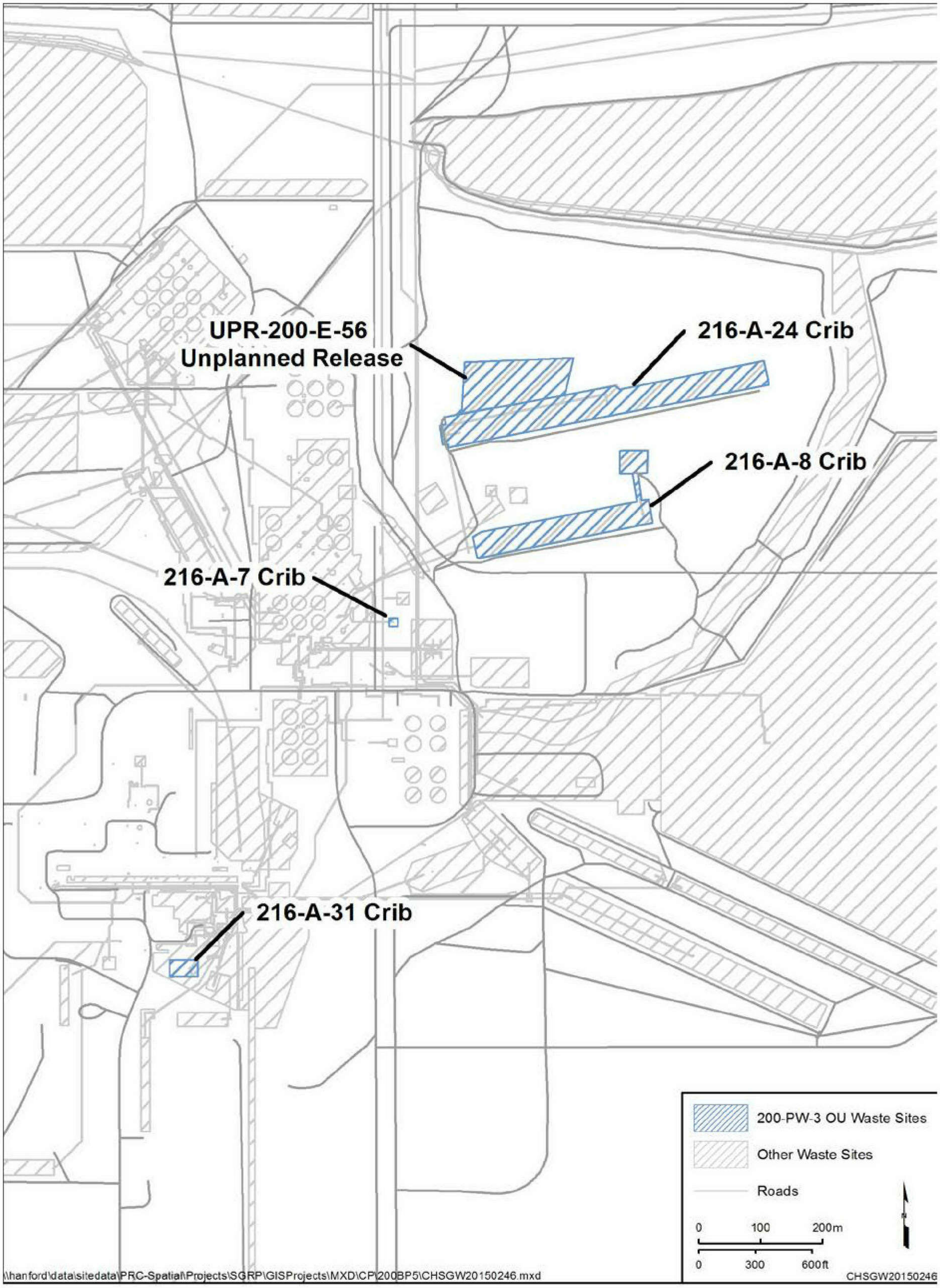

Figure A-18. Location of the 200-PW-3 OU Waste Sites

Cesium-137 and NPH are the primary constituents of interest at these sites. Table A-3 shows the operating history of the primary waste streams for these waste sites.

The following subsections of this appendix provide brief descriptions of the 200-PW-3 OU waste sites addressed in the RD/RAWP.

Table A-3. 200-PW-3 OU Waste Sites

Waste Site	Period of Operation	Primary Waste Stream
216-A-8 Crib[a]	1955 to 1958 1966 to 1985 (intermittent)	Neutral-to-basic Low-Salt aqueous-phase waste, containing organics and cesium-137
216-A-24 Crib[a]	1958 to 1966	
UPR-200-E-56 Site[b]	1979 (discovery date)	
216-A-7 Crib	1956 to 1957	Neutral-to-basic Low-Salt aqueous-phase waste, containing organics and cesium-137
	1966	Nonaqueous-phase organic liquid
216-A-31 Crib	1964 to 1966	Neutral-to-basic organic-phase waste, containing cesium-137

a. In 1958, the 216-A-24 Crib replaced the 216-A-8 Crib. In 1966, the waste stream was diverted back from the 216-A-24 Crib to the 216-A-8 Crib. The 216-A-24 Crib was believed to be valved out of service in 1966, but the valve was found to be open in 1979.

b. This contaminated site was discovered in 1979 during routine monitoring. Low volumes of contaminated waste from the adjacent 216-A-24 Crib most likely seeped laterally to this location.

A1.3.1 216-A-7 Crib

The 216-A-7 Crib is located in the 200 East Area, approximately 40 m (130 ft) east of the 241-A Tank Farm. The surface elevation at the 216-A-7 Crib is approximately 206.4 m (677 ft). The 216-A-7 Crib was constructed in a 4.9 m (16 ft) deep excavation with a 3 by 3 m (10 by 10 ft) base. Perforated 15 cm (6 in.) vitrified clay pipe was used to distribute discharged liquids within the crib. The base of this piping is about 3.7 m (12 ft) below the current ground surface. Approximately 2.1 m (7 ft) of coarse rock lies between the pipe and the native soils at the base of the excavation, which is about 5.8 m (19 ft) below the current ground surface.

The 216-A-7 Crib received aqueous liquid discharges in 1956 and 1957 and was replaced by the 241-A-302B Catch Tank in 1959. In November 1966, the crib received a one-time discharge of the organic inventory used for a 6-month process test at PUREX. The crib was deactivated in 1966 and isolated by blanking the effluent pipeline. In total, the site received approximately 326,000 L (86,100 gal) of effluent, of which 246,000 L (65,000 gal) were received in 1966.

The 216-A-7 Crib shares a common radiological surface contamination area with the 216-A-1 Crib (located to the northeast of 216-A-7). In 1992, contaminated surface soil near these two cribs was scraped and consolidated on top of the 216-A-1 and 216-A-7 Cribs. The entire area was then stabilized (covered) with 46 to 61 cm (18 to 24 in.) of uncontaminated backfill, increasing the surface elevation by about 1 m (3 ft).

A1.3.2 216-A-8 Crib

The 216-A-8 Crib is located approximately 177 m (580 ft) east of the A Tank Farm in the 200 East Area at a surface elevation of approximately 198 m (650 ft). The bottom dimensions of the crib are 259 by 6 m (850 by 20 ft). The long axis of the crib trends to the east-northeast. A 61 cm (24 in.) diameter, schedule 20, perforated distribution line extends the length of the crib and rests on a 2 m (6.5 ft) thick layer of rock capped by a 30 cm (12 in.) thick layer of gravel. The gravel fill is mounded over the distribution line. Two layers of Sisalkraft® building paper cover the gravel and prevent overlying native sand backfill from filling the void space. The crib floor was excavated to a uniform elevation of 195 m (639.5 ft). The depth of the excavation varied from 4.9 to 5.8 m (16 to 19 ft.) below the 1955 ground surface. Water entered the crib through the 216-A-508 Diversion Box, located due west of the crib.

The 216-A-8 Crib was initially taken out of service in May 1958, when the discharged volume was approaching the inventory limit calculated for strontium-90. In January 1966, the 216-A-8 Crib was reactivated when a re-evaluation indicated it had not reached its waste capacity. In 1983, the 216-A-8 Crib was determined to meet all serviceability criteria for use during PUREX startup in 1984. The crib last received waste in 1985. The site was surface stabilized in September 1990 by the addition of 0.6 m (2 ft) of clean fill. The crib was permanently isolated in April 1995 by filling the 216-A-508 Diversion Box with concrete.

Over its operational life, the 216-A-8 Crib received an estimated 1.15 billion L (303.8 Mgal) of process effluent. The estimated discharged inventory for the 216-A-8 Crib included 390.8 kg (861 lb) of uranium, 2,410 Ci of cesium-137, 128,600 kg (283,500 lb) of TBP, 55,110 kg (121,500 lb) of NPH, and 24,561 Ci of tritium. However, the remedial investigation activities detected no organics (DOE/RL-2006-51, *Remedial Investigation Report for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*).

A1.3.3 216-A-24 Crib

The 216-A-24 Crib is located in the 200 East Area, approximately 140 m (460 ft) east of the 241-AN Tank Farm, and north of the 216-A-8 Crib. Surface elevation at the site is approximately 198 m (650 ft). The 216-A-24 Crib is composed of four inline sections, each 107 m (350 ft) long, and each 1.8 m (6 ft) lower than the previous section and separated from the next by a soil berm. At its base, the crib is 427 m (1,400 ft) long and 6 m (20 ft) wide. Waste was distributed to the crib through a 38 cm (15 in.) diameter corrugated galvanized pipe that is perforated on the bottom half. In each section, the waste distribution line is placed horizontally in the middle of a 1.3 m (4.3 ft) bed of gravel, which is overlain by a polyethylene barrier and enough clean backfill to bring the excavation back to grade. The overlying ground surface dips to the east, such that the distribution line is approximately 1.5 m (5 ft) closer to the surface at the end of the section than it is at the beginning. The base of the waste distribution pipe ranges between 2.7 and 4.3 m (9 and 14 ft) below grade, depending on its location within the section. Eight 20 cm (8 in.) diameter wells on concrete pads are located on this crib. The wells extend from the bottom of the crib to 0.9 m (3 ft) above grade. In addition, four 38 cm (15 in.) corrugated risers with filter box assemblies extend from the distributor pipe to grade.

The 216-A-24 Crib was constructed to replace the 216-A-8 Crib liquid waste site. It received Low-Salt, neutral-to-basic radioactive vapor condensate from the 241-A, 241-AX, 241-AY, and 241-AZ Tank Farms. After the crib was constructed, surface condensers were installed in the tank farms, which greatly reduced the waste volume discharged to the crib. As a result, most of the waste volume was discharged to the first two of the four crib sections. Over its operational life, the 216-A-24 Crib received an estimated 820 million L (216.5 Mgal) of process effluent. The estimated discharged inventory for the 216-A-24

® Sisalkraft is an expired registered trademark of American Reinforced Paper Company, Attleboro, Massachusetts.

Crib included 65 kg (143 lb) of uranium; 401 Ci of cesium-137; 21,420 kg (47,200 lb) of TBP; 9,192 kg (20,300 lb) of NPH; and 8,798 Ci of tritium.

The 216-A-24 Crib was taken out of service in December 1965 when it reached its waste capacity. In 1979, the valve to the 216-A-24 Crib was found to be open, allowing the waste site to have continued to receive effluent until then. The site was surface stabilized in 1988.

A1.3.4 216-A-31 Crib

The 216-A-31 Crib is located in the 200 East Area, roughly 125 m (410 ft) south of PUREX and 19 m (61 ft) south of the 216-A-2 Crib. The surface elevation at the 216-A-31 Crib is roughly 217 m (712 ft). The 216-A-31 Crib is 21 by 3 m (70 by 10 ft) at the bottom and 7.3 m (24 ft) deep. A 7.6 cm (3 in.) diameter stainless steel perforated distribution pipe was placed horizontally 6.4 m (21 ft) below grade in the upper portion of a 0.9 m (3 ft) thick bed of gravel. The gravel was covered with polyethylene sheeting and 5 cm (2 in.) of sand, and the crib was backfilled to grade.

The 216-A-31 Crib was a belowgrade liquid waste site that was used from 1964 to 1966 to dispose of organic, Low-Salt, neutral-to-basic liquid waste from the 202-A Building L Cell, via the 241-A-151 Diversion Box. This waste stream had previously been discharged to the 216-A-2 Crib. The inventory discharged to the 216-A-31 Crib is estimated to include 371 Ci of cesium-137; 19,800 kg (43,700 lb) of TBP; and 8,491 kg (18,700 lb) of NPH. The site was deactivated in 1966 by blanking the L Cell nozzles to the diversion box.

The 216-A-31 Crib was taken out of service in November 1966. The effluent volume was between 10,000 and 30,545 L (2,600 and 8,070 gal).

A1.3.5 UPR-200-E-56

The UPR-200-E-56 site is located immediately north of the 216-A-24 Crib in the 200 East Area. The site has a surface elevation of approximately 196 m (643 ft). The site originated as a sloping excavation intended to generate clean borrow material for backfilling around the then new, below-grade 241-AN Tanks. The final excavation ranged from 1.5 to 6.1 m (5 to 20 ft) deep (estimated) and was 131 m (430 ft) long and an average of 33.5 m (110 ft) wide. During radiation monitoring, performed in June 1979, the excavation was found to be moist and radioactively contaminated. The moisture and contamination appears to be effluent waste from the adjacent 216-A-24 Crib that had seeped laterally over the surface of a 10 cm (4 in.) thick hardpan crust approximately 4.6 m (15 ft) bgs. The location was not intended to receive effluent discharges.

Upon discovery of contamination, the pit was refilled with contaminated soil retrieved from the 241-AN Tanks location and UPRs associated with the 241-C Tank Farm and the 200 East Area (UPR-200-E-91, UPR-200-E-92, and UPR-200-E-93). These soils are expected to have low-level radioactive contamination that is homogeneously distributed as a result of mixing of soils during transfers. The site then was covered with 15 to 20 cm (6 to 8 in.) of clean soil. In 1985, contaminated soil from the 244-A Lift Station (UPR-200-E-100) was disposed at this site, and the site was restabilized with 0.6 m (2 ft) of clean soil.

Neither the volume of effluent that migrated laterally from the 216-A-24 Crib to UPR-200-E-56 nor the associated contaminant inventory is known. The contaminant inventory contained in the soils imported from other sites also is not known.

A1.4 200-PW-6 Operable Unit

The 200-PW-6 OU contains four waste sites located in the 200 West Area. These include the 216-Z-10 Injection/Reverse Well, 216-Z-5 Crib, 216-Z-8 French Drain, and 241-Z-8 Settling Tank. Figure A-19 shows the location of the 200-PW-6 OU waste sites in the 200 West Area.

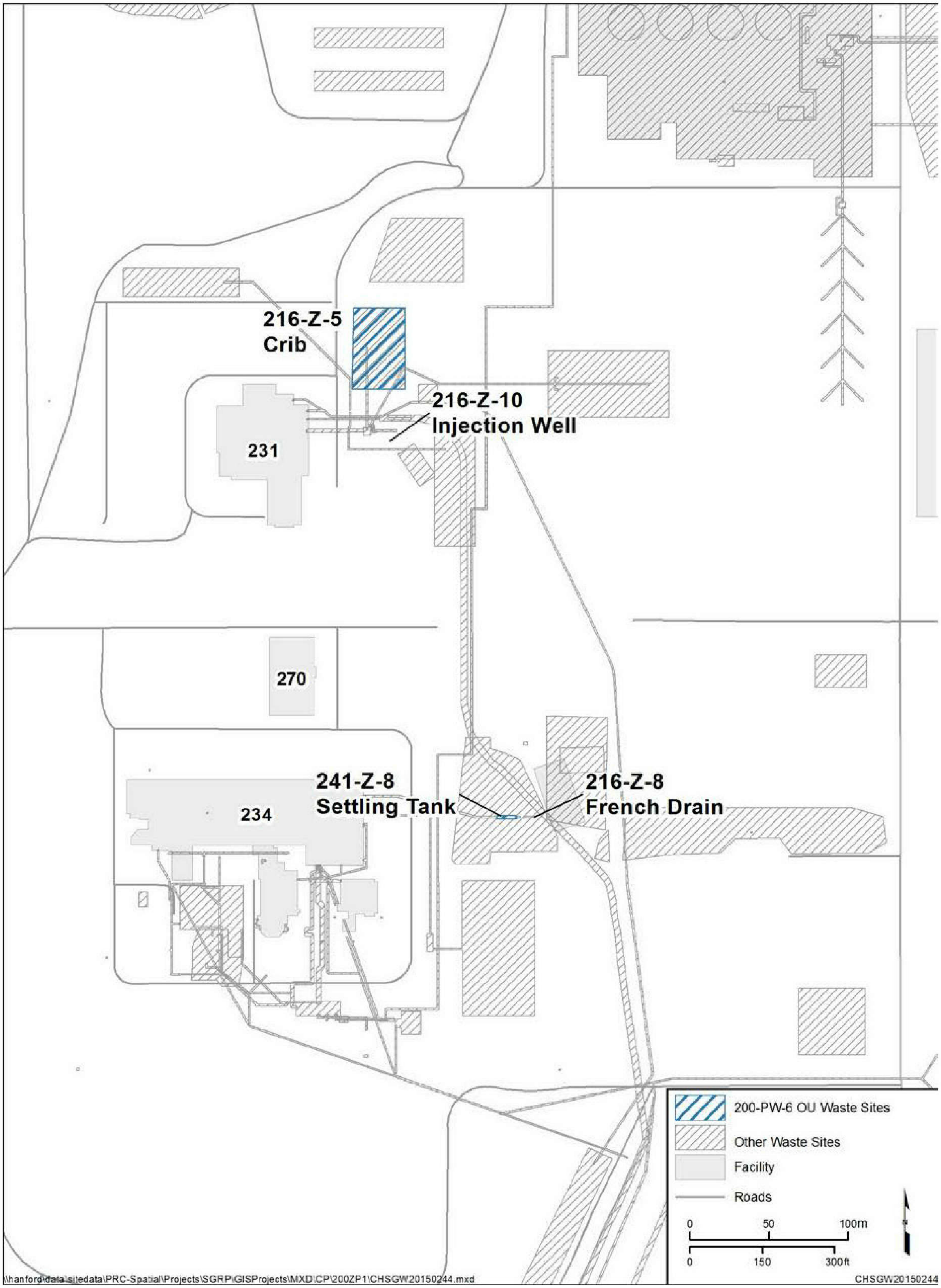

Figure A-19. Location of the 200-PW-6 OU Waste Sites

These waste sites received wastes from the Plutonium Isolation Facility or the PFP Complex that contained plutonium but not organics. The 216-Z-10 Injection/Reverse Well and 216–Z-5 Crib received aqueous, neutral-to-basic process and laboratory wastes from the Plutonium Isolation Facility (231-Z Building). The 241-Z-8 Settling Tank received aqueous silica gel waste from back flushes of the feed filters at RECUPLEX. Overflow from the 241-Z-8 Settling Tank went to the 216-Z-8 French Drain. Table A-4 shows the operating history primary waste streams for these waste sites.

Table A-4. 200-PW-6 OU Waste Sites

Waste Site	Primary Period of Operation	Primary Waste Stream
216-Z-10 Injection/Reverse Well	February to June 1945	Neutral-to-basic low-salt aqueous wastes, containing plutonium
216-Z-5 Crib*	1945 to 1947	
241-Z-8 Settling Tank	1955 to 1962	
216-Z-8 French Drain	1955 to 1962	

* In 1945, the 216-Z-5 Crib replaced the 216-Z-10 Injection/Reverse Well.

The following subsections of this appendix provide brief descriptions of the 200-PW-6 OU waste sites addressed in the RD/RAWP.

A1.4.1 216-Z-5 Crib

The 216-Z-5 Crib is in the 200 West Area, approximately 36 m (118 ft) east-northeast of the 231-Z Building. The surface elevation at the site is approximately 207 m (678 ft). The 216-Z-5 Crib was a liquid waste site that was used from 1945 to 1947 to dispose of 231-Z Building process waste that accumulated in the 231-W-151 Vault. The crib consists of two, inline, interconnected 3.8 m (12 ft) square, 1.2 m (4 ft) deep wooden sump boxes that are open at the bottom. Each box was placed at the bottom of a 5.5 m (18 ft) deep rectangular excavation that was approximately 4.3 m (14 ft) square at the base, and then covered with fill to bring the site back to original grade. The two boxes were roughly 20 m (65 ft) apart on center. The crib was oriented north-south, and effluent was piped in from the southern end.

The 216-Z-5 Crib was taken out of service in February 1947 because the soil porosity had been sealed by the sludge in the waste discharged to the crib. In total, the 216-Z-5 Crib received 31 million L (8.18 Mgal) of effluent. The discharged inventory was estimated to include 340 g (0.75 lb) of plutonium and 100,000 kg (220,000 lb) of nitrate. The site was stabilized (a layer of clean soil added to the ground surface) in 1990. An excavated view of the 216-Z-5 Crib with locations of wells and boreholes is shown in Figure A-20.

A1.4.2 216-Z-8 French Drain

The 216-Z-8 French Drain is located east of the 234-5Z Building and approximately 94 m (308 ft) northwest of the 216-Z-9 Trench in the 200 West Area. The surface elevation at the site is approximately 205.2 m (673.2 ft). The French drain bottom dimensions form a 1.5 by 1.5 m (5 by 5 ft) square with angled walls. The bottom 0.9 m (3 ft) of the excavation is backfilled with clean, graded gravel. A seal of building paper was laid over the gravel with a 0.9 m (3 ft) diameter hole to match the two sections of a 0.9 m (3 ft) vitrified clay pipeline placed end-to-end over the hole. A concrete collar was poured around the bottom of the clay pipeline on the top of the building paper. The clay pipeline was filled with gravel and capped with building paper and a wire mesh reinforced-concrete slab to seal the top of the structure.

Figure A-20. Excavated View of 216-Z-5 Crib with Wells and Boreholes

The overflow pipe from the 241-Z-8 Settling Tank entered through the center of the concrete cap of the French drain. Woven wire mesh was placed at the opening of the pipe into the French drain to ensure a void space at the waste inlet. The entire structure was backfilled, resulting in the top of the structure being 2.5 m (8 ft) below grade.

Waste overflow entered the gravel-filled excavation at 4.4 m (14 ft) below grade from the 241-Z-8 Settling Tank. The total volume filled with gravel in the French drain was more than 4 m^3 (141 ft^3). The French drain was designed, assuming a net porosity of 30 percent, such that more than 1,000 L (265 gal) of solution could be accommodated. This was sufficient capacity to permit the waste solution to percolate into the sediments beneath the French drain between batch discharges of waste and rinse water from the 241-Z-8 Settling Tank.

The 216-Z-8 French Drain received low-level plutonium contaminated waste from the 234-5Z Building from 1955 to 1962. No organic waste was discharged to the 216-Z-8 French Drain. The waste stream was dilute and neutral, with no fission or activation product content, and was relatively low in both disposal rate and total disposal volume. It is estimated that 9,590 L (2,530 gal) of liquid waste containing an estimated 48.2 g (1.7 oz) of plutonium overflowed from the 241-Z-8 Settling Tank to the 216-Z-8 French Drain by the time it was retired in 1962. The 216-Z-8 French Drain was taken out of service in June 1962 following a criticality accident in the 234-5Z Building in April 1962 that forced closure of the RECUPLEX process.

A characterization well (299-W15-202) was drilled in 1980, and soil samples were collected to define the plutonium and americium distribution beneath the 216-Z-8 French Drain (RHO-RE-EV-46 P, *The 216-Z-8 French Drain Characterization Study*). The well was located less than 1 m (3 ft) south of the 216-Z-8 French Drain and was drilled to 53.6 m (176 ft) bgs. A maximum value of 457 pCi/g of americium-241 was reported at 6.1 m (20 ft) bgs, near the bottom of the 216 Z-8 French Drain. A maximum plutonium-239 value of 4,620 pCi/g was reported at 7.6 m (25 ft) bgs. Results indicate that plutonium and americium were sorbed onto sediments within a few meters beneath the French drain. Based on these results, the nature and extent of contamination are suspected to be confined to a shallow vadose zone region directly adjacent to the 216-Z-8 French Drain.

A1.4.3 216-Z-10 Injection/Reverse Well

The 216-Z-10 Injection/Reverse Well is located approximately 30.5 m (100 ft) east of the 231-Z Building in the 200 West Area. The 216-Z-10 Injection/Reverse Well also has been known as the 231-W Reverse Well, 231-W-151 Dry Well or Reverse Well, 231-Z Well, 299-W15-51, 231-W-150, and 216-Z-2. The surface elevation at the site is approximately 206.3 m (676.8 ft).

The 216-Z-10 Injection/Reverse Well was drilled in September 1944. The well was 0.15 m (6 in.) in diameter and constructed of Schedule 40 steel pipe. The drilling log reported depth to bottom at 45.7 m (150 ft) bgs, with a capped flange extending approximately 0.31 m (1 ft) above grade. Three inlet pipes enter the well at 1.5 m (5 ft), 1.8 m (6 ft), and 2.1 m (7 ft) bgs. Historical drawings suggest that a 1.3 cm (0.5 in.) copper tube extends from ground surface to 0.6 m (2 ft) bgs, where it enters the 216-Z-10 Injection/Reverse Well and may extend to the well bottom. The well was perforated from 36 to 45.7 m (118 to 150 ft) bgs, with a cement plug in the bottom. On November 24, 1944, the well was tested with 7,571 L (2,000 gal) of water pumped into the well at a rate of 379 L/min (100 gal/min.). Results of this test showed no static water 5 minutes after pumping had stopped.

The 216-Z-10 Injection/Reverse Well received process and laboratory waste from the 231-Z Building via the 231-Z-151 Sump between February and June 1945. It is estimated that 988,000 L (260,000 gal) of liquid containing up to 50 g (1.6 oz) of plutonium was discharged to the well at approximately 76 L/min (20 gal/min). No other radionuclides were reported to have been released to the 216-Z-10 Injection/ Reverse Well (HW-9671, *Underground Waste Disposal at Hanford Works: An Interim Report Covering the 200 West Area*).

The 216-Z-10 Injection/Reverse Well was taken out of service in June 1945 when the well became plugged with sludge. The well was deactivated by capping the waste feed piping at the 231-W-151 Diversion Box (231-Z-151 Sump).

A1.4.4 241-Z-8 Settling Tank

The 216-Z-8 Settling Tank is located in the 200 West Area, roughly 61 m (200 ft) east of the 234-5Z Building and 91 m (300 ft) west-northwest of the 216-Z-9 Trench. The surface elevation at the site is approximately 205.2 m (673.2 ft). The 241-Z-8 Settling Tank is a cylindrical tank that is 12.2 m (40 ft) long and 2.4 m (8 ft) in diameter. It is constructed of 0.8 cm (0.31 in.) thick steel or wrought iron plate and oriented horizontally at about 1.8 m (6 ft) below grade. The tank was fed by two 3.8 cm (1.5 in.) diameter stainless steel pipes that enter the western end of the tank about 15 cm (6 in.) below the tank top. A single pipeline exits the opposite end of the tank, to direct overflow to the 216-Z-8 French Drain, approximately 11 m (36 ft) to the east (Figure A-21).

Figure A-21. 241-Z-8 Settling Tank

The 241-Z-8 Settling Tank was in service from 1955 to 1962, receiving pH neutral effluent waste from back flushes of the RECUPLEX feed filters. Silica gel was added to the waste stream as a settling agent, and the effluent was flushed to the 241-Z-8 Settling Tank with nitric acid. Overflow from the tank was piped to the 216-Z-8 French Drain. It was 1957 before the volume of effluent discharged to the tank surpassed the tank capacity (58,500 L [15,435 gal]), and liquids might have begun overflowing to the 216-Z-8 French Drain. Physical measurements of the tank contents in 1959 showed that the tank had reached its overflow capacity, indicating that waste was overflowing to the 216-Z-8 French Drain.

The 241-Z-8 Settling Tank was taken out of service in June 1962 following a criticality accident in the 234-5Z Building in April 1962 that forced closure of the RECUPLEX process. April 1974 surveillance data reported the tank contents as 29,000 L (7,650 gal) of liquids and 1,880 L (500 gal) of sludge. Because the tank was expected to be at capacity, the 27,580 L (7,285 gal) shortfall suggested a tank leak may have occurred, prompting efforts to remove residual tank liquids. Laboratory analysis of samples collected at the time of the surveillance and in May 1974 suggested a residual plutonium inventory of between 8 and 1,444 g (0.28 and 51 oz). Liquids present in the tank had a pH of 6.

To mitigate any ongoing potential for leaks, all pumpable liquid was removed from the tank, and the tank was flushed with 18,800 L (5,000 gal) of "fifty percent caustic solution," leaving approximately 18 cm (7 in.) of sludge, equivalent to 1,880 L (500 gal). A sample of this sludge, collected in October 1974, measured a pH of 6.1 and contained a plutonium concentration of 0.02 g/L. This concentration, averaged across the residual sludge volume, would indicate a residual plutonium inventory of about 38 g. Based on the variability in plutonium concentrations detected in the earlier sludge sampling event, the total plutonium inventory in the residual sludge is estimated to be no more than 1,500 g, and may be less than one-half that amount.

A2 References

ARH-2155, 1971, *Radioactive Liquid Waste Disposal Facilities - 200 West Area*, Atlantic Richfield Hanford Company, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0080807H.

DOE/RL-91-32, 1991, *Expedited Response Action Proposal (EE/CA & EA) for 200 West Area Carbon Tetrachloride Plume*, Draft B, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=D196078303.

DOE/RL-91-58, 1992, *Z Plant Source Aggregate Area Management Study Report*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=D196124396.

DOE/RL-2003-11, 2004, *Remedial Investigation Report for the 200-CW-5 U Pond/Z Ditches Cooling Water Group, the 200-CW-2 S Pond and Ditches Cooling Water Group, the 200-CW-4 T Pond and Ditches Cooling Water Group, and the 200-SC-1 Steam Condensate Group Operable Units*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=1111300811.

DOE/RL-2006-51, 2007, *Remedial Investigation Report for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at:
http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=DA05807591.
http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=DA05807868.
http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0805130070.
http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0805130071.

HW-9671, 1948 (declassified 1980), *Underground Waste Disposal at Hanford Works: An Interim Report Covering the 200 West Area*, Health Instrument Department, Hanford Works, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0082586H.

RHO-LD-114, 1981, *Existing Data On the 216-Z Liquid Waste Sites*, Rockwell Hanford Operations, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=D196055124.

RHO-RE-EV-46 P, 1984, *The 216-Z-8 French Drain Characterization Study*, Rockwell Hanford Operations, Richland, Washington.

RHO-ST-21, 1978, *Report On Plutonium Mining Activities At 216-Z-9 Enclosed Trench*, Rockwell Hanford Operations, Richland, Washington.

SGW-40456, 2009, *Performance Evaluation Report for Soil Vapor Extraction Operations at the 200-PW-1 Operable Unit Carbon Tetrachloride Site, Fiscal Year 2008*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0095859.

WHC-EP-0707, 1994, *216-U-10 Pond and 216-Z-19 Ditch Characterization Studies*, Rev. 0, Westinghouse Hanford Company, Richland, Washington. Available at: http://www.osti.gov/bridge/servlets/purl/10156239-4GYXOL/native/.

Appendix B

Summary of Regulatory Requirements

This page intentionally left blank.

Contents

Tables

This page intentionally left blank.

Terms

ARAR	applicable or relevant and appropriate requirement
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
ET	evapotranspiration
MCL	maximum contaminant level
OU	operable unit
RCRA	*Resource Conservation and Recovery Act of 1976*
RD/RAWP	remedial design/remedial action work plan
RTD	removal, treatment (as needed), and disposal

This page intentionally left blank.

B1 Introduction

This appendix provides a description of how the applicable or relevant and appropriate requirements (ARARs) will be implemented within the remedial design/remedial action work plan (RD/RAWP). Table B-1 is the compliance matrix that shows the section of the RD/RAWP where the work will be performed to comply with federal ARARs. Table B-2 is the compliance matrix that shows the section of the RD/RAWP where the work will be performed to comply with Washington State ARARs. The compliance matrices include the ARAR quote from the record of decision (EPA et al., 2011, *Record of Decision Hanford 200 Area Superfund Site 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*), source document, method of implementation, and section of the RD/RAWP that describes the implementing method.

Table B-1. Federal ARARs Compliance Matrix

Requirement	Source Document	Implementation	RD/RAWP Section
"National Emission Standards for Hazardous Air Pollutants," 40 CFR 61, "National Emission Standard for Asbestos," Subpart M; "Applicability," 40 CFR 61.140			
"Standard for Demolition and Renovation," 40 CFR 61.145	40 CFR 61.145	The requirements will be satisfied by the work activities that will be conducted to mobilize the project prior to start of RTD operations. These work activities will establish removal requirements based on quantity present and handling requirements. These requirements will also specify handling and disposal requirements for regulated sources that have the potential to emit asbestos. Specifically, no visible emissions are allowed during handling, packaging, and transport of asbestos-containing materials.	4.3.1, Manage 200-CW-5 and 200-PW-1/3/6 Remediation
"Standard for Waste Disposal for Manufacturing, Fabricating, Demolition, Renovation, and Spraying Operations," 40 CFR 61.150	40 CFR 61.150	Defines applicability for the removal and disposal of certain sources of asbestos during demolition activities. This remedial action does not expect to encounter asbestos-containing materials during RTD of waste sites.	4.3.1, Manage 200-CW-5 and 200-PW-1/3/6 Remediation
"National Primary Drinking Water Regulations," 40 CFR 141			
"Maximum Contaminant Levels for Inorganic Contaminants," 40 CFR 141.62	40 CFR 141.62	This regulation establishes MCLs that are drinking water criteria designed to protect human health from potential adverse effects of inorganic contaminants in drinking water. Groundwater remediation is not within the scope of this RD/RAWP; however, remedies will be implemented to ensure that groundwater is protected.	4.3.1, Manage 200-CW-5 and 200-PW-1/3/6 Remediation

Table B-1. Federal ARARs Compliance Matrix

Requirement	Source Document	Implementation	RD/RAWP Section
"Maximum Contaminant Levels for Organic Contaminants," 40 CFR 141.61	40 CFR 141.61	This regulation establishes MCLs that are drinking water criteria designed to protect human health from potential adverse effects of organic contaminants in drinking water. Groundwater remediation is not within the scope of this RD/RAWP; however, remedies will be implemented to ensure that groundwater is protected.	4.3.1, Manage 200-CW-5 and 200-PW-1/3/6 Remediation
"Maximum Contaminant Levels for Radionuclides," 40 CFR 141.66	40 CFR 141.66	This regulation establishes MCLs that are drinking water criteria designed to protect human health from potential adverse effects of radionuclides in drinking water. Groundwater remediation is not within the scope of this RD/RAWP; however, remedies will be implemented to ensure that groundwater is protected.	4.3.1, Manage 200-CW-5 and 200-PW-1/3/6 Remediation
"Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions," 40 CFR 761			
"Applicability" Specific Subsections: 40 CFR 761.50(b)(1) 40 CFR 761.50(b)(2) 40 CFR 761.50(b)(3) 40 CFR 761.50(b)(4) 40 CFR 761.50(b)(7) 40 CFR 761.50(c)	40 CFR 761.50(b)(1)	The waste management plan will address polychlorinated biphenyl waste disposal.	5.3, Waste Management

Table B-1. Federal ARARs Compliance Matrix

Requirement	Source Document	Implementation	RD/RAWP Section
Federal Historic Laws			
Archeological and Historic Preservation Act of 1974, 16 USC 469a-1 through 469a-(2)d, et seq.	16 USC 469a-1(a)	The requirements in this regulation will be satisfied by the work activities that will be conducted to acquire the remediation system(s) for the 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 OUs. The work activity processes will ensure that these data are documented. This regulation does not require protection of the actual waste site or facility.	4.3.1, Manage 200-CW-5 and 200-PW-1/3/6 Remediation
Endangered Species Act of 1973, 16 USC 1531, Subsection 16 USC 1536(c), et seq.	16 USC 1536(c)	The requirements in this regulation will be satisfied by the work activities that will be conducted to acquire the remediation system(s) for the 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 OUs. If remediation is within critical habitat or buffer zones surrounding threatened or endangered species, mitigation measures must be taken to protect the resource. This remedial action is not expected to affect any critical habitat or buffer zones.	5.4, Cultural/Ecological Resources

Table B-1. Federal ARARs Compliance Matrix

Requirement	Source Document	Implementation	RD/RAWP Section
National Historic Preservation Act of 1966, et seq. 16 USC 470, Section 106, et seq.	16 USC 470, Section 106	The requirements in this regulation will be satisfied by the work activities that will be conducted to acquire the remediation system(s) for the 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 OUs. Work activity processes will identify effects on cultural properties through identification, evaluation, and mitigation processes, and consultation with interested parties will be conducted as needed. This remedial action is not expected to affect any cultural properties.	5.4, Cultural/Ecological Resources
Native American Graves Protection and Repatriation Act of 1990, 25 USC 3001, et seq.	25 USC 3001	The requirements in this regulation will be satisfied by the work activities that will be conducted to acquire the remediation system(s) for the 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 OUs. Prior to disturbance of earth, a survey will be completed. The survey will look for culturally significant items and document such with respect to the areas included in this remedial action in regards to earth disturbance. This remedial action is not expected to affect any human remains, associated and unassociated funerary objects, sacred objects, and items of cultural patrimony.	5.4, Cultural/Ecological Resources

ARAR = applicable or relevant and appropriate requirement
MCL = maximum contaminant level
OU = operable unit
RD/RAWP = remedial design/remedial action work plan
RTD = removal, treatment (as needed), and disposal

Table B-2. Washington State ARARs Compliance Matrix

Requirement	Source Document	Implementation	RD/RAWP Section
"Model Toxics Control Act–Cleanup," WAC 173-340			
"Deriving Soil Concentrations for Groundwater Protection," WAC 173-340-747(3)	WAC 173-340-747(3)	WAC 173-340-747(3) provides an overview of deriving soil concentrations. The appropriate method will be selected from subsections (4) through (10) to determine contaminant concentration in the soil that will protect groundwater.	6.1, Remedial Action Exit Strategy
"Groundwater Cleanup Standards," "Standard Method B Potable Groundwater Cleanup Levels," WAC 173-340-720(4)(b)(iii)(A) and (B), and "Adjustments to Cleanup Levels," WAC 173-340-720(7)(b)	WAC 173-340-720(4)(b)(iii)(A) and (B) WAC 173-340-720(7)(b)	Uses Method B equations 720-1 and 720-2 to calculate groundwater cleanup levels for noncarcinogens and carcinogens, respectively. Requires an adjustment downward of Method B groundwater cleanup levels based on an existing state or federal cleanup standard so that the total excess cancer risk does not exceed 1×10^{-5}, and the hazard index does not exceed 1. Groundwater remediation is not within the scope of this RD/RAWP; however, remedies will be implemented to ensure that groundwater is protected.	6.1, Remedial Action Exit Strategy
"Site-Specific Terrestrial Ecological Evaluation Procedures," WAC 173-340-7493(3)	WAC 173-340-7493(3)	Process and methods established in this regulation will be used to determine chemical cleanup values to protect terrestrial ecology.	6.1, Remedial Action Exit Strategy
"Soil Cleanup Standards for Industrial Properties," WAC 173-340-745(5)(b)	WAC 173-340-745(5)(b)	Process and methods established in this regulation will be used to establish chemical cleanup values to protect human health from direct contact with the soil and other environmental media.	6.1, Remedial Action Exit Strategy

Table B-2. Washington State ARARs Compliance Matrix

Requirement	Source Document	Implementation	RD/RAWP Section
"Ambient Air Quality Standards and Emission Limits for Radionuclides," WAC 173-480			
"Emission Monitoring and Compliance Procedures," WAC 173-480-070(2)	WAC 173-480-070(2)	The air monitoring plan will address radionuclide emissions by calculating the dose to members of the public at the point of maximum annual air concentration in an unrestricted area where any member of the public may be.	3.2.2, Air Monitoring Plans
"General Standards for Maximum Permissible Emissions," WAC 173-480-050(1)	WAC 173-480-050(1)	The air monitoring plan will address radionuclide emissions to include that the most stringent control of emissions by federal or state regulation or limitation in effect at the time of implementation will be used.	3.2.2, Air Monitoring Plans
"Controls for New Sources of Toxic Air Pollutants," WAC 173-460			
"Ambient Impact Requirement," WAC 173-460-070	WAC 173-460-070	The requirements in WAC 173-460-070 will be satisfied by the work activities that will be conducted to acquire the remediation system(s) for the 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 OUs. These work activity processes will ensure that any new toxic air pollutant source that is likely to increase toxic air pollutant emissions shall demonstrate that emissions from the source are sufficiently low to protect human health and safety from potential carcinogenic and/or other toxic effects.	4.3.1, Manage 200-CW-5 and 200-PW-1/3/6 Remediation
"Applicability," WAC 173-460-030, and "Control Technology Requirements," WAC 173-460-060	WAC 173-460-030	Substantive requirements of these standards are applicable to this remedial action because there is the potential for toxic air pollutants to become airborne as a result of decontamination, demolition, and excavation activities.	4.3.1, Manage 200-CW-5 and 200-PW-1/3/6 Remediation

Table B-2. Washington State ARARs Compliance Matrix

Requirement	Source Document	Implementation	RD/RAWP Section
"Dangerous Waste Regulations," WAC 173-303			
"Recycled, Reclaimed, and Recovered Wastes," WAC 173-303-120 Specific Subsections: WAC 173-303-120(3) and WAC 173-303-120(5)	WAC 173-303-120(3)	WAC 173-303-120 describes the requirements for recycling materials that are solid wastes and dangerous. This project is not expected to recycle the removed waste.	5.3, Waste Management
WAC 173-303-120(5) provides for the recycling of used oil.	WAC 173-303-120(5)	WAC 173-303-120 describes the requirements for recycling materials that are solid wastes and dangerous. This project is not expected to recycle used oil.	5.3, Waste Management
"Closure and Post-Closure" WAC 173-303-610(2)	WAC 173-303-610(2)	The requirements in WAC 173-303-610(2) are not expected to be implemented since there are no treatment, storage, and/or disposal units included in the remedial action.	4.3.1, Manage 200-CW-5 and 200-PW-1/3/6 Remediation
"Conditional Exclusion of Special Wastes," WAC 173-303-073	WAC 173-303-073	WAC 173-303-073 establishes the conditional exclusion of special waste. This project is not expected to generate special waste.	5.3, Waste Management
"Designation of Dangerous Waste," WAC 173-303-070(3)	WAC 173-303-070(3)	The waste management plan will address designation of solid waste.	5.3, Waste Management
"Excluded Categories of Waste," WAC 173-303-071	WAC 173-303-071	WAC 173-303-071 provides a list of exemptions and defines applicability. The waste generated by this remedial action is not expected to meet any excluded categories.	5.3, Waste Management

Table B-2. Washington State ARARs Compliance Matrix

Requirement	Source Document	Implementation	RD/RAWP Section
"Identifying Solid Waste," WAC 173-303-016	WAC 173-303-016	WAC 173-303-016 identifies materials that are and are not solid waste. The remedial action will manage the various types of solid waste from generation, shipment, and eventual disposal. The remedial action does not expect to generate non-solid waste.	5.3, Waste Management
"Land Disposal Restrictions," WAC 173-303-140(4)	WAC 173-303-140(4)	The waste management plan will address disposal of land disposal-restricted solid waste including treatment technologies needed.	5.3, Waste Management
"On-site containerized storage, collection and transportation standards for solid waste" WAC 173-304-200	WAC 173-304-200	This remedial action is not expected to generate any nondangerous/ nonradioactive waste. If it does, the substantive requirements will be followed.	5.3, Waste Management
"Recycling Processes Involving Solid Waste," WAC 173-303-017	WAC 173-303-017	WAC 173-303-017 identifies materials that are and are not solid waste when recycled. The remedial action is not expected to generate any solid waste for recycling.	5.3, Waste Management
"Requirements for Generators of Dangerous Waste," WAC 173-303-170	WAC 173-303-170	The waste management plan will address generation of solid waste.	5.3, Waste Management
"Requirements for Universal Waste," WAC 173-303-077 Identifies those wastes exempted from regulation under WAC 173-303-140 and WAC 173-303-170 through 173-303-9907, "Reserved" (excluding WAC 173-303-960, "Special Powers and Authorities of the Department").	WAC 173-303-077	The waste management plan will address universal waste.	5.3, Waste Management
"Requirements," WAC 173-303-64620(4)	WAC 173-303-64620(4)	Implementation of the CERCLA remedial action will meet the technical requirements of RCRA corrective action.	4.3.1, Manage 200-CW-5 and 200-PW-1/3/6 Remediation

Table B-2. Washington State ARARs Compliance Matrix

Requirement	Source Document	Implementation	RD/RAWP Section
"General Regulations for Air Pollution Sources," WAC 173-400			
"General Standards for Maximum Emissions," WAC 173-400-040, and "Requirements for New Sources in Attainable or Unclassifiable Areas," WAC 173-400-113	WAC 173-400-040	The requirements in WAC 173-400-040 will be satisfied by the work activities that will be conducted to acquire the remediation system(s) for the 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 OUs. The work activity process will use methods of control to minimize the release of air contaminants associated with fugitive emissions resulting from materials handling, construction, demolition, or other operations. Emissions are to be minimized through application of best available control technology.	4.3.1, Manage 200-CW-5 and 200-PW-1/3/6 Remediation
	WAC 173-400-113	The requirements in WAC 173-400-113 will be satisfied by the work activities that will be conducted to acquire the remediation system(s) for the 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 OUs.	4.3.1, Manage 200-CW-5 and 200-PW-1/3/6 Remediation
"Minimum Standards for Construction and Maintenance of Wells," WAC 173-160			
"What Are the Equipment Cleaning Standards?" WAC 173-160-440	WAC 173-160-440	The requirements in WAC 173-160-440 will be satisfied by the work activities that will be conducted to demobilize the remediation system(s) for the 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 OUs. The work activity process will identify equipment cleaning standards.	4.3.4, Enhance Soil Cover, Install ET Barriers, and Demobilize Project

Table B-2. Washington State ARARs Compliance Matrix

Requirement	Source Document	Implementation	RD/RAWP Section
"What Are the General Construction Requirements for Resource Protection Wells?" WAC 173-160-420	WAC 173-160-420	The requirements in this regulation will be satisfied by the work activities that will be conducted to demobilize the remediation system(s) for the 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 OUs. The work activity process will identify the general construction requirements for resource protection wells.	4.3.4, Enhance Soil Cover, Install ET Barriers, and Demobilize Project
"What Are the Minimum Casing Standards?" WAC 173-160-430	WAC 173-160-430	The requirements in this regulation will be satisfied by the work activities that will be conducted to demobilize the remediation system(s) for the 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 OUs. The work activity processes will identify minimum casing standards.	4.3.4, Enhance Soil Cover, Install ET Barriers, and Demobilize Project
"What Are the Minimum Standards for Resource Protection Wells and Geotechnical Soil Borings?" WAC 173-160-400	WAC 173-160-400	The requirements in this regulation will be satisfied by the work activities that will be conducted to demobilize the remediation system(s) for the 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 OUs. The work activity processes will identify the minimum standards for resource protection wells and geotechnical soil borings.	4.3.4, Enhance Soil Cover, Install ET Barriers, and Demobilize Project
"What Are the Well Sealing Requirements?" WAC 173-160-450	WAC 173-160-450	The requirements in WAC 173-160-450 will be satisfied by the work activities that will be conducted to demobilize the remediation system(s) for the 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 OUs. The work activity processes will identify the well sealing requirements.	4.3.4, Enhance Soil Cover, Install ET Barriers, and Demobilize Project

Table B-2. Washington State ARARs Compliance Matrix

Requirement	Source Document	Implementation	RD/RAWP Section
"What Is the Decommissioning Process for Resource Protection Wells?" WAC 173-160-460	WAC 173-160-460	The requirements in WAC 173-160-460 will be satisfied by the work activities that will be conducted to demobilize the remediation system(s) for the 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 OUs. The work activity processes will identify the decommissioning process for resource protection wells.	4.3.4, Enhance Soil Cover, Install ET Barriers, and Demobilize Project
"Radiation Protection – Air Emissions," WAC 246-247			
"General Standards," WAC 246-247-040(3) WAC 246-247-040(4)	WAC 246-247-040(3)	The requirements in WAC 246-247-040(3) will be satisfied by the work activities that will be conducted to acquire the remediation system(s) for the 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 OUs. The work activity processes will control emissions to ensure that emission standards are not exceeded. Actions creating new sources or significantly modified sources shall apply best available controls. All other actions shall apply reasonably achievable controls.	4.3.1, Manage 200-CW-5 and 200-PW-1/3/6 Remediation
"Monitoring, Testing, and Quality Assurance," WAC 246-247-075(3) Methods to implement periodic confirmatory monitoring for minor sources may include estimating the emissions or other methods as approved by the lead agency.	WAC 246-247-075(3)	The air monitoring plan will address radionuclide emissions. The work activity processes will implement methods for periodic confirmatory monitoring for minor sources and may include estimating the emissions or other methods as approved by the lead agency.	3.2.2, Air Monitoring Plans

Table B-2. Washington State ARARs Compliance Matrix

Requirement	Source Document	Implementation	RD/RAWP Section
"Monitoring, Testing, and Quality Assurance," WAC 246-247-075(8) Facility (site) emissions resulting from nonpoint and fugitive sources of airborne radioactive material shall be measured. Measurement techniques may include ambient air measurements, or inline radiation detector or withdrawal of representative samples from the effluent stream, or other methods as determined by the lead agency.	WAC 246-247-075(8)	The air monitoring plan will address radionuclide emissions. The work activity processes will ensure that facility (site) emissions resulting from nonpoint and fugitive sources of airborne radioactive material shall be measured. Measurement techniques may include ambient air measurements, inline radiation detection, withdrawal of representative samples from the effluent stream, or other methods.	3.2.2, Air Monitoring Plans
"Monitoring, Testing, and Quality Assurance," WAC 246-247-075(1), (2), and (4)	WAC 246-247-075(1)	The air monitoring plan will address radionuclide emissions. The work processes will establish the monitoring, testing, and quality assurance requirements for radioactive air emissions from major sources. Effluent flow rate measurements shall be made, and the effluent stream shall be directly monitored continuously with an inline detector, or representative samples of the effluent stream shall be withdrawn continuously from the sampling site following the specified guidance. The requirements for continuous sampling are applicable to batch processes when the unit is in operation. Periodic sampling (grab samples) may be used only with lead agency prior approval. Such approval may be granted in cases where continuous sampling is not practical, and radionuclide emission rates are relatively constant. In such cases, grab samples shall be collected with sufficient frequency so as to provide a representative sample of the emissions.	3.2.2, Air Monitoring Plans

Table B-2. Washington State ARARs Compliance Matrix

Requirement	Source Document	Implementation	RD/RAWP Section
		When it is impractical to measure the effluent flow rate at a source in accordance with the requirements or to monitor or sample an effluent stream at a source in accordance with the site selection and sample extraction requirements, the facility owner or operator may use alternative effluent flow rate measurement procedures or site selection and sample extraction procedures as approved by the lead agency. Emissions from nonpoint and fugitive sources of airborne radioactive material shall be measured. Measurement techniques may include but are not limited to sampling, calculation, smears, or other reasonable methods for identifying emissions.	
"National Standards Adopted by Reference for Sources of Radionuclide Emissions," WAC 246-247-035(1)(a)(ii)	WAC 246-247-035(1)(a)(ii)	The requirements in WAC 246-247-035(1)(a)(ii) will be satisfied by the work activities that will be conducted to acquire the remediation system(s) for the 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 OUs. The work activity processes will establish requirements equivalent to 40 CFR 61, Subpart H, "National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities." Radionuclide airborne emissions from the facility shall be controlled so as not to exceed amounts that would cause an exposure to any member of the public of greater than 10 mrem/yr effective dose equivalent.	4.3.1, Manage 200-CW-5 and 200-PW-1/3/6 Remediation

Table B-2. Washington State ARARs Compliance Matrix

Requirement	Source Document	Implementation	RD/RAWP Section
"Solid Waste Handling Standards," WAC 173-350			
"On-Site Storage, Collection and Transportation Standards," WAC 173-350-300	WAC 173-350-300	The waste management plan will address temporary onsite storage of solid waste in a container and the collecting and transporting of the solid waste.	5.3, Waste Management

ARAR = applicable or relevant and appropriate requirement
CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
ET = evapotranspiration
OU = operable unit
RCRA = *Resource Conservation and Recovery Act of 1976*
RD/RAWP = remedial design/remedial action work plan

B2 References

40 CFR 61, "National Emission Standards for Hazardous Air Pollutants," *Code of Federal Regulations*. Available at: http://www.gpo.gov/fdsys/pkg/CFR-2010-title40-vol8/xml/CFR-2010-title40-vol8-part61.xml.

61.140, "Applicability."

61.145, "Standard for Demolition and Renovation."

61.150, "Standard for Waste Disposal for Manufacturing, Fabricating, Demolition, Renovation, and Spraying Operations."

Subpart H, "National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities."

Subpart M, "National Emission Standard for Asbestos."

40 CFR 141, "National Primary Drinking Water Regulations," *Code of Federal Regulations*. Available at: http://www.gpo.gov/fdsys/pkg/CFR-2010-title40-vol22/xml/CFR-2010-title40-vol22-part141.xml.

141.61, "Maximum Contaminant Levels for Organic Contaminants."

141.62, "Maximum Contaminant Levels for Inorganic Contaminants."

141.66, "Maximum Contaminant Levels for Radionuclides."

40 CFR 761, "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions," *Code of Federal Regulations*. Available at: http://www.gpo.gov/fdsys/pkg/CFR-2010-title40-vol30/xml/CFR-2010-title40-vol30-part761.xml.

751.50, "Applicability."

Archeological and Historic Preservation Act of 1974, 16 USC 469 – 469c-2. Available at: http://www.nps.gov/history/local-law/fhpl_archhistpres.pdf.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601 et seq., Pub. L. 107-377, December 31, 2002. Available at: http://epw.senate.gov/cercla.pdf.

Endangered Species Act of 1973, Pub. L. 93-205, as amended, 7 USC 136, 16 USC 1531, et seq. Available at: http://www.nmfs.noaa.gov/pr/pdfs/laws/esa.pdf.

EPA, Ecology, and DOE, 2011, *Record of Decision Hanford 200 Area Superfund Site 200-CW-5 and 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0093644.

Native American Graves Protection and Repatriation Act of 1990, Pub. L. 101-601, as amended, 25 USC 3001, et seq. Available at: http://www.nps.gov/history/local-law/FHPL_NAGPRA.pdf.

National Historic Preservation Act of 1966, Pub. L. 89-665, as amended, 16 USC 470, et seq. Available at: http://www.achp.gov/docs/nhpa%202008-final.pdf.

Resource Conservation and Recovery Act of 1976, 42 USC 6901, et seq. Available at: http://www.epa.gov/epawaste/inforesources/online/index.htm.

WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-160.

160-400, "What Are the Minimum Standards for Resource Protection Wells and Geotechnical Soil Borings?"

160-420, "What Are the General Construction Requirements for Resource Protection Wells?"

160-430, **"**What Are the Minimum Casing Standards?"

160-440, "What Are the Equipment Cleaning Standards?"

160-450, "What Are the Well Sealing Requirements?"

160-460, "What Is the Decommissioning Process for Resource Protection Wells?"

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-303.

303-016, "Identifying Solid Waste."

303-017, "Recycling Processes Involving Solid Waste."

303-070, "Designation of Dangerous Waste."

303-071, "Excluded Categories of Waste."

303-073, "Conditional Exclusion of Special Wastes."

303-077, "Requirements for Universal Waste."

303-120, "Recycled, Reclaimed, and Recovered Wastes."

303-140, "Land Disposal Restrictions."

303-170, "Requirements for Generators of Dangerous Waste."

303-610, "Closure and Post-Closure."

303-64620, "Requirements."

303-960, "Special Powers and Authorities of the Department."

303-9907, "Reserved."

WAC 173-340, "Model Toxics Control Act—Cleanup," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-340.

340-720, "Groundwater Cleanup Standards."

340-745, "Soil Cleanup Standards for Industrial Properties."

340-747, "Deriving Soil Concentrations for Groundwater Protection."

340-7493, "Site-Specific Terrestrial Ecological Evaluation Procedures."

WAC 173-350, "Solid Waste Handling Standards," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-350.

350-300, "On-Site Storage, Collection and Transportation Standards."

WAC 173-400, "General Regulations for Air Pollution Sources," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-400.

400-040, "General Standards for Maximum Emissions."

400-113, "Requirements for New Sources in Attainable or Unclassifiable Areas."

WAC 173-460, "Controls for New Sources of Toxic Air Pollutants," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-460.

460-030, "Applicability."

460-060, "Control Technology Requirements."

460-070, "Ambient Impact Requirement."

WAC 173-480, "Ambient Air Quality Standards and Emission Limits for Radionuclides," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-480.

480-050, "General Standards for Maximum Permissible Emissions."

480-070, "Emission Monitoring and Compliance Procedures."

WAC 246-247, "Radiation Protection—Air Emissions," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=246-247.

247-035, "National Standards Adopted by Reference for Sources of Radionuclide Emissions."

247-040, "General Standards."

247-075, "Monitoring, Testing, and Quality Assurance."

Appendix C

Basis of Estimate

This page intentionally left blank.

Contents

Table

Workbooks

This page intentionally left blank.

Terms

AACE	American Association of Cost Estimators, International
CAM	Cost Account Manager
CCS	contamination control structure
CD	critical decision
CDR	conceptual design report
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CSDR	conceptual safety design report
CWC	Central Waste Complex
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
ERDF	Environmental Restoration Disposal Facility
ET	evapotranspiration
FLS	first line supervisor
FTE	full-time employee
FWS	Field Work Supervisor
HEO	heavy equipment operator
HVAC	heating, ventilating, and air conditioning
ID	identification
IH	industrial health
IPT	integrated project team
IS	industrial safety
KOP	knock-out pot
LLW	low-level waste
NDA	nondestructive assay
ODC	other direct cost
OU	operable unit
PDSA	preliminary documented safety analysis
PRB	Project Review Board

QA	quality assurance
QC	quality control
RC	Radiological Control
RCT	Radiological Control Technician
RO/RO	roll-on/roll-off
RPS	Radiation Protection Systems
RTD	removal, treatment (as needed), and disposal
SAP	sampling and analysis plan
SDS	safety design strategy
SLB2	standard large box 2
SVE	soil vapor extraction
SWB	standard waste box
TIPR	technically independent project review
TRU	transuranic
WBS	work breakdown structure
WE	weather enclosure
WIPP	Waste Isolation Pilot Plant

C1 Basis of Estimate for Remedial Actions at the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units

This is a rough order magnitude cost estimate that is suitable for use in requesting project funding and submittal of the Justification for Mission Need (Critical Decision 0). The estimate is a Class III feasibility study type of estimate, which relies upon an expert opinion methodology to define activities and general budgetary levels of labor, subcontract, and material costs. Beyond the expressions of cost found in this appendix, no activity-based calculations have been performed. The estimate provides a cost range, with a relatively low level of cost detail that is reliant upon descriptions and assumptions.

This appendix has six sections, one for each of the five work packages defined within the remedial design/remedial action work plan and one that describes the remediation crews that were defined to execute the work. Workbooks 1 through 5 contain the work activities identified in the critical path schedule for each work package, including the activity identification, activity name, activity description, estimated start date, duration (workdays), earned value method, and a list of resources required to accomplish each work activity. Workbook 6 describes the crews that were identified to accomplish the remedial actions, including the type of work activities, resource codes, resource quantities, resource titles, hourly cost for each resource type, and hourly cost for the specified resource quantity. Table C-1 provides a description of the activities contained in each workbook.

Table C-1. Workbook Cost Estimates for Activities

Workbook	Work Package Title
1	Manage 200-CW-5 and 200-PW-1/3/6 Remediation
2	Remove, Treat, and Dispose Contaminated Soil and Debris
3	Remove, Treat, and Dispose Settling Tanks
4	Enhance Soil Cover, Install ET Barriers, and Demobilize Project
5	Long-Term Stewardship
6	Work Crews and Costs

C2 References

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601 et seq., Pub. L. 107-377, December 31, 2002. Available at: http://epw.senate.gov/cercla.pdf.

DOE-STD-3006-2010, 2010, *Planning and Conducting Readiness Reviews*, DOE Technical Standard, U.S. Department of Energy, Washington, D.C. Available at: http://energy.gov/sites/prod/files/2013/06/f1/doe-std-3006-2010.pdf.

DOE O 413.3B, 2010, *Program and Project Management for the Acquisition of Capital Assets*, U.S. Department of Energy, Washington, D.C. Available at: https://www.directives.doe.gov/directives-documents/400-series/0413.3-BOrder-b/view.

DOE O 425.1D, 2011, *Verification of Readiness to Start Up or Restart Nuclear Facilities*, U.S. Department of Energy, Washington, D.C. Available at: http://energy.gov/sites/prod/files/2013/06/f1/O-425-1D_ssm.pdf.

WH Publication 1246, 2009, *The Davis-Bacon Act, as Amended*, Wage and Hour Division, U.S. Department of Labor, Washington, D.C. Available at: http://www.dol.gov/whd/regs/statutes/dbra.pdf.

Workbook 1

Manage 200-CW-5 and 200-PW-1/3/6 Remediation

This page intentionally left blank.

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS: 1.01	**PREPARER: Steve Ferries**
WBS Title: Manage 200-CW-5 and 200-PW-1/3/6 Remediation	**CAM: Patrick Baynes**
	Support/Review: Joseph Urquidi

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.01**				**PREPARER: Steve Ferries**
WBS Title:	**Manage 200-CW-5 and 200-PW-1/3/6 Remediation**				**CAM: Patrick Baynes**
					Support/Review: Joseph Urquidi
Activity ID:	**1.1.1**				
Activity Name:	Project Management and Support for 200-CW-5 and 200-PW-1/3/6 Remediation				
Activity Description: Project Management and Support for remediation of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units includes: • Prepare applicable Project Management Documentation per DOE Orders and Federal Regulations. • Provide guidance and direction through project initiation to project demobilization and closeout. • Coordinate interfaces, (e.g. DOE and Regulator document reviews, Project Readiness Review, Defense Nuclear Facilities Safety Board, Central Waste Complex, Tank Farms, Utilities, other ongoing Operations, Safeguards, Groundwater Monitoring). • Manage Project in accordance with Earned Value Management System (Act as Control Account Manager, develop project schedules, track and report on Project performance).					
Estimated Start Date:	Project Start + 75 weeks				
Duration (workdays):	3650				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 1	Project Management Crew	36500	$22,728,185		Project Management and Support for 200-CW-5 and 200-PW-1/3/6
	Unrealized Risk Contingency		$60,435,704		
	ODCs - (travel, materials, etc.)			$2,494,917	3% of Activity costs
	General and Administrative			$17,131,761	20% of subtotal
	contingency			$12,848,821	AACE class 3, 15%
	Total			**$115,639,388**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS: **1.01**

WBS Title: **Manage 200-CW-5 and 200-PW-1/3/6 Remediation**

PREPARER: Steve Ferries
CAM: Patrick Baynes
Support/Review: Joseph Urquidi

Activity ID:	**1.1.2**				
Activity Name:	Acquire Remediation System for 200-CW-5 and 200-PW-1/3/6				

Activity Description: Acquire the remediation system(s) for 200-CW-5 and 200-PW-1/3/6 (e.g. hire and train staff, follow contractor requirements document for DOE O 413.3B [including design, procurement/construction/installation/testing of remediation systems], submit Quarterly Startup Notification Report, prepare operating procedures [integrate Nuclear Safety, Criticality Safety, Radiological Controls, Industrial Hygiene, Industrial Safety, Environmental, Air Monitoring Program, and Waste Management], and demonstrate readiness).

To address uncertainties in technology applications associated with RTD of various waste sites, particularly in regards to remote operations and sludge retrieval from the 241-Z-361 Settling Tank, technology selection and demonstration will be achieved through use of prototypes and mock-up(s) early in the remediation design process. Consistent with the DOE O 413.3B critical decision process, the technology selection will align with development of conceptual design and a technology readiness assessment will be conducted prior to major expenditure on final system design, procurement, and construction. The mock-up(s) will also be used to enhance personnel training where appropriate.

The design will incorporate measures to achieve operating efficiencies necessary to support the project schedule. Weather Enclosures (WE) will be incorporated into the design where needed to achieve soil and debris removal rates or protect Contamination Control Structures (CCS) from the environment. WEs and CCSs will be designed for ease of re-location within wor

Estimated Start Date:	Project Start + 0 weeks				
Duration (workdays):	1813				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
	ODCs - (travel, materials, etc.)			$0	3% of Activity costs
	General and Administrative			$0	N/A
	contingency			$0	N/A
	Total			**$0**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS: 1.01					**PREPARER: Steve Ferries**
WBS Title: Manage 200-CW-5 and 200-PW-1/3/6 Remediation					**CAM: Patrick Baynes**
					Support/Review: Joseph Urquidi
Activity ID:	**1.1.2.1**				
Activity Name:	Request and Obtain Project Funding				
Activity Description: This activity is part of the work package "Project Management and Support for 200-CW-5 and 200-PW-1/3/6 Remediation". It is highlighted on the schedule because it is usually a 2 year process and is necessary to initiate the project acquisition.					
Estimated Start Date:	Project Start + 0 weeks				
Duration (workdays):	298				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
				$0	The cost to complete this is captured in WBS 1.1.1
	ODCs - (travel, materials, etc.)			$0	3% of Activity costs
	General and Administrative			$0	N/A
	Contingency			$0	N/A
	Total			**$0**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.01**				**PREPARER: Steve Ferries**
WBS Title:	**Manage 200-CW-5 and 200-PW-1/3/6 Remediation**				**CAM: Patrick Baynes**
					Support/Review: Joseph Urquidi
Activity ID:	**1.1.2.2**				
Activity Name:	CD-0, Approve Mission Need				
Activity Description:	Justification for Mission Need documentation developed based on the approved remedial design/remedial action work plan.				
Estimated Start Date:	Project Start + 75 weeks				
Duration (workdays):	108				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
E010	Chemical Engineers	1080	$106,790		
E050	Environmental Engineers	1080	$84,056		
P160	Technical Writers & Editors	540	$39,242		Resource P160 is at 50% usage
	ODCs - (travel, materials, etc.)			$6,903	3% of Activity costs
	General and Administrative			$47,398	20% of subtotal
	Contingency			$35,549	AACE Class 3, 15%
	Total			**$319,938**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS: 1.01

WBS Title: Manage 200-CW-5 and 200-PW-1/3/6 Remediation

PREPARER: Steve Ferries
CAM: Patrick Baynes
Support/Review: Joseph Urquidi

Activity ID:	**1.1.2.3**				
Activity Name:	CD-0 to CD-1, Approve Alternative Selection and Cost Range				

Activity Description: Alternative Selection and Cost Range documentation developed and approved based on the approved CD-0:
• Project Execution Plan, including the environmental regulatory strategy, the tailoring strategy, the acquisition strategy, plan for implementation of the Integrated Safety Management System, and QA program requirements.
• Functions and requirements document (FRD) and functional design criteria (FDC).
• Safety Design Strategy (SDS), including DOE Richland Operations Office approval, and update after CDR completion.
• Preliminary hazard analysis (PHA) and preliminary fire hazards analysis (PFHA).
• Capital determination and major modification determination.
• Plant forces work review (PFWR) and work turndown, as applicable, to ensure compliance with WH Publication 1246, The Davis-Bacon Act, as amended, requirements.
• Establishment of a contractor integrated project team (IPT) via a project manager approved charter.
• Security assessment to establish preliminary security requirements.
• Risk management plan.
• Project code of record.
• Siting evaluation and archeological and cultural reviews.
• Alternatives Analysis and a CDR, which will include the following:
- Authorize early procurement for mockup
- Project cost estimate and project schedule
- Conceptual design
- Formal CDR Design Review, based on CDR Design Review Plan.
• Technology selection for remediation, including mock-up testing.
• Conceptual Safety Design Report (CSDR).
• Contractor project review board (PRB) review after preparation of the completed CD-1 Package, based on a PRB Review Plan.
• Support during DOE integrated project team (IPT) and technically independent project review (TIPR) team reviews of the CD-1 package.
• Support during DOE review of the CSDR and completion of a conceptual safety validation report.
• Support during DOE development of an independent cost estimate (or independent cost review).

Estimated Start Date:	Project Start + 102 weeks				
Duration (workdays):	432				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
E010	Chemical Engineers	4320	$427,162	$0	
E020	Civil Engineers	1296	$155,870	$0	30% of time
E050	Environmental Engineers	1296	$100,868	$0	30% of time
E070	Mechanical Engineers	1296	$138,141	$0	30% of time
E080	Nuclear Engineers	4320	$633,269	$0	Nuclear Safety and Criticality Engineers
E120	Safety Engineers	4320	$397,051	$0	Safety and Fire Protection
M010	First Line Supervisors	1296	$118,882	$0	30% of time (operations input)
P090	Industrial Hygienists	1296	$128,187	$0	30% of time
S010	Chemists	1296	$128,667	$0	30% of time
	Subcontract (CDR/AA) + Subcontract (Independent Review)			$1,214,210	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS: 1.01 **WBS Title: Manage 200-CW-5 and 200-PW-1/3/6 Remediation**					**PREPARER: Steve Ferries** **CAM: Patrick Baynes** **Support/Review: Joseph Urquidi**
Mockup					
1-21	1-21 Subcontract			$2,487,226	Contract 36402-18 Laboratory Support to Sludge Treatment Project
1-21	1-21 Subcontract			$1,249,861	Contract 36402-19 Technical Services Providing Continuing Storage of Sludge Samples
1-21	1-21 Subcontract			$17,843	Contract 36402-28 Support for Sludge Treatment Safety Basis Development
1-21	1-21 Subcontract			$1,385,936	Contract 36402-33 Technical Support for Sludge Treatment Engineering
1-21	1-21 Subcontract			$7,828,063	Contract 36402-40 Planning/Sampling/Analyzing Floor Sludge
Subcontract	Tech Support, Steven Blush			$48,956	Mockup
1-21	KOP Crane Support			$146,573	Mockup
1-21	Motor Carrier Support			$7,889	Mockup
1-21	Inter-company Work Exchange Agreement			$7,284	Mockup
1-21	Cask Vent Test Article			$8,096	Mockup
1-21	Compressed Air Test Article			$152,563	Mockup
1-21	KOP Disposition Test/Work Platform			$764,384	Mockup
1-21	Low Pressure Sensing Instrumentation			$14,998	Mockup
1-21	KOP Pretreat Material Leveling Tool			$7,321	Mockup
	KOP Pretreat Canister Depth Gauge			$4,662	Mockup
	Earth Resources Technology Satellite Process Equipment Structural Analysis			$41,911	Mockup
	KOP Verify Container and Volume Measuring Tool			$224,530	Mockup
	KOP Separate Screen Production Article			$117,190	Mockup
	KOP Monorail Trolley Rack			$64,370	Mockup
	KOP Canister Pour Cover Latch Modification			$15,014	Mockup
	KOP Verification Container Handling Temporary Labeling Tracking System			$21,263	Mockup
	KOP Spreader Bar			$18,400	Mockup
	KOP Empty Basket Grapple			$37,475	Mockup
	Mod Transfer Hose			$49,913	Mockup
1-21	Preliminary Tech Maturation Plan			$406,434	Mockup

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS: 1.01					**PREPARER: Steve Ferries**
WBS Title: Manage 200-CW-5 and 200-PW-1/3/6 Remediation					**CAM: Patrick Baynes**
					Support/Review: Joseph Urquidi
1-21	Engineered Container Retrieval and Transfer System Hose-in-Hose Transfer Line Assays			$624,482	Mockup
1-21	Annex Constructability Review			$28,511	Mockup
1-21	Nuclear Safety Support			$33,933	Mockup
1-21	Seismic Switches			$906,324	Mockup
1-21	Hydro Lance			$123,312	Mockup
1-21	Readiness Review			$84,975	Mockup
	MSA Crane Rental			$281,759	108 days of crane rental (assume 50% of time)
	Subcontracts (allowance)			$5,000	
	Materials (Allowance)			$5,000	
	Other NOS (Allowance)			$5,000	
	ODCs - (travel, materials, etc.)			$620,063	3% of activity costs
	General and Administrative			$4,257,764	20% of subtotal
	Contingency			$7,451,087	AACE Class 3, 35%
	Total			**$32,997,671**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS: **1.01**

WBS Title: **Manage 200-CW-5 and 200-PW-1/3/6 Remediation**

PREPARER: Steve Ferries
CAM: Patrick Baynes
Support/Review: Joseph Urquidi

Activity ID: **1.1.2.4**

Activity Name: CD-1 to CD-2, Approve Performance Baseline

Activity Description: Performance baseline documentation developed and approved based on the approved CD-1:
• Performance Baseline for DOE approval.
• Update and approval of the project execution plan (PEP), SDS, security requirements, and quality assurance program requirements (as necessary) with DOE review and approval, based on project evolution.
• Ecological review.
• Support for DOE Technology Readiness Assessment, including preparation of Technology Maturation Plan.
• Support during DOE IPT and TIPR team reviews of the CD-2/3 package.
• Preliminary and Final Design, which will include:
- Drawings, technical analyses, and construction specifications
- Formal Design Review, based on Design Review Plan.

Estimated Start Date:	Project Start + 210 weeks
Duration (workdays):	432
Earned Value Method:	% Complete

Resource ID	Resource Description	Hours	Labor $$	Nonlabor $$	Comment
E010	Chemical Engineers	4320	$427,162		full time
E020	Civil Engineers	1296	$155,870		30% of time
E050	Environmental Engineers	1296	$100,868		30% of time
E070	Mechanical Engineers	1296	$138,141		30% of time
E080	Nuclear Engineers	4320	$633,269		Nuclear Safety and Criticality Engineers
E120	Safety Engineers	4320	$397,051		Safety and Fire Protection
M010	First Line Supervisors	1296	$118,882		30% of time (operations input)
P070	Planner/Scheduler/Estimators	1296	$107,736		30% of time
P090	Industrial Hygienists	1296	$128,187		30% of time
S010	Chemists	1296	$128,667		30% of time
	Subcontract for preliminary design			$3,009,379	3% of the Total Acquisition Cost (w/o contingency)
	Perma-Con Containment Structure, 120' x 150' (includes lighting fixtures)			$5,966,711	1 perma-con at the beginning of the project to show concept and begin working out the logistics
	Perma-Con Structure Delivery, via 5 trucks			$20,000	
	Perma-Con, RPS site engineer to oversee assembly			$25,000	
	ODCs - (travel, materials, etc.)			$340,708	3% of Activity costs
	General and Administrative			$2,339,526	20% of subtotal
	Contingency			$4,094,171	AACE Class 3, 35%
	Total			**$18,131,327**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.01**				**PREPARER: Steve Ferries**
WBS Title:	**Manage 200-CW-5 and 200-PW-1/3/6 Remediation**				**CAM: Patrick Baynes**
					Support/Review: Joseph Urquidi
Activity ID:	**1.1.2.5**				
Activity Name:	CD-2 to CD-3, Approve Start of Construction/Execution				

Activity Description: Design, procurement, and construction documentation developed and approved based on the approved CD-1
• Hazard analysis report (HAR), preliminary safety functions document, preliminary safety equipment list, and a preliminary documented safety analysis (PDSA).
• Construction project safety and health and safety plan (HASP).
• Checkout, Testing, and Commissioning Plan in preparation for acceptance and turnover of systems and equipment at CD-4.
• Contractor Project Review Board (PRB) review after preparation of the completed CD-2/3 Package, based on a PRB review plan.
• Support during DOE IPT and TIPR team reviews of the CD-2/3 package.
• Support during DOE review of the PDSA and completion of the associated safety evaluation report.

Estimated Start Date:	Project Start + 210 weeks				
Duration (workdays):	432				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
E010	Chemical Engineers	4320	$427,162		
E020	Civil Engineers	1296	$155,870		30% of time
E050	Environmental Engineers	1296	$100,868		30% of time
E070	Mechanical Engineers	1296	$138,141		30% of time
E080	Nuclear Engineers	4320	$633,269		Nuclear Safety and Criticality Engineers
E120	Safety Engineers	4320	$397,051		Safety and Fire Protection
M010	First Line Supervisors	1296	$118,882		Operations input, 30% of time
P090	Industrial Hygienists	1296	$128,187		30% of time
S010	Chemists	1296	$128,667		30% of time
	Subcontract for final Design			$12,037,516	12% of the Total Acquisition Cost (w/o contingency)
	ODCs - (travel, materials, etc.)			$427,968	3% of activity costs
	General and Administrative			$2,938,716	20% of subtotal
	Contingency			$5,142,753	AACE Class 3, 35%
	Total			**$22,775,050**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS: 1.01	**PREPARER: Steve Ferries**
WBS Title: Manage 200-CW-5 and 200-PW-1/3/6 Remediation	**CAM: Patrick Baynes**
	Support/Review: Joseph Urquidi

Activity ID:	**1.1.2.6**				
Activity Name:	CD-3 to CD-4, Approve Start of Operations or Project Completion				

Activity Description: Procurement, construction, and startup documentation developed and approved based on the approved CD-2 and CD-3:
• Procurement, construction, and installation of systems and equipment required for remediation operations.
• Title III support for construction, procurement, installation and testing.
• Preparation and implementation of documented safety analyses and technical safety requirement documents (and any transportatio safety document) consistent with the SDS.
• Procedures, work packages, training materials, and all remaining required operations and maintenance documentation required to initiate remediation operations.
• All regulatory documentation required for start of operations (e.g., remedial design report).
• Testing (factory acceptance tests, construction acceptance tests, operational tests), mock-ups, and dry runs necessary to achieve operational readiness.
• Systems/equipment turnover for operations, including as-built drawings and spare parts.
• All other activities required to demonstrate readiness consistent with requirements of DOE O 425.1D,*Verification of Readiness to Start Up or Restart Nuclear Facilities* , and DOE-STD-3006-2010, *Planning and Conductive Readiness Reviews.*
• Support during DOE operational readiness review.

Estimated Start Date:	Project Start + 318 weeks				
Duration (workdays):	432				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 1	Project Management Crew	160	$99,630		1 month of training
Crew 2	Operations Management & Support Crew	2160	$6,417,738		1 year of training
Crew 3	Mobilization Crew	160	$217,613		1 month of training
Crew 4	Pipeline Excavation Crew	2160	$2,735,742		1 year of training
Crew 5	Overburden Crew	2160	$1,697,032		1 year of training
Crew 6	WE/CCS Setup Crew	2160	$4,735,742		1 year of training
Crew 7	Excavation Crew (>5 nCi TRU per gram of waste)	2160	$2,401,518		1 year of training
Crew 8	Excavation Crew (<5 nCi TRU per gram of waste)	2160	$2,318,542		1 year of training
Crew 9	241-Z-8 Settling Tank Crew	160	$191,758		1 month of training
Crew 10	241-Z-361 Settling Tank Crew	2160	$2,915,728		1 year of training
Crew 11	Waste Relocation Crew	2160	$2,772,012		1 year of training
Crew 12	Process Area Crew	2160	$2,566,359		1 year of training
Crew 13	Ship to CWC	160	$143,300		1 month of training
Crew 14	Ship to ERDF	160	$168,172		1 month of training
Crew 15	Sampling Crew	2160	$948,953		1 year of training
Crew 16	Backfill and soil cover crew	160	$193,533		1 month of training
Crew 17	Barrier Crew	160	$104,471		1 month of training
Crew 18	Demobilization Crew	160	$337,552		1 month of training
E010	Chemical Engineers	4320	$427,162		full time
E020	Civil Engineers	1296	$155,870		30% of time
E050	Environmental Engineers	1296	$100,868		30% of time
E070	Mechanical Engineers	1296	$138,141		30% of time
E080	Nuclear Engineers	4320	$633,269		Nuclear Safety and Criticality Engineers

WBS: 1.01					**PREPARER: Steve Ferries**
WBS Title: Manage 200-CW-5 and 200-PW-1/3/6 Remediation					**CAM: Patrick Baynes**
					Support/Review: Joseph Urquidi
E120	Safety Engineers	4320	$397,051		Safety and Fire Protection
M010	First Line Supervisors	1296	$118,882		30% of time (operations input)
P090	Industrial Hygienists	1296	$128,187		30% of time
S010	Chemists	1296	$128,667		30% of time
	Subcontract (readiness support)			$1,003,126	1% of Overall Acquisition (w/o contingencies)
	Blade (Cat 120M) Purchased			$290,000	A total of 1
	Brokk 260 L3 RH Machine Remotely Operated Machine			$2,180,490	A total of 3
	Brokk 800 Machine			$1,701,420	A total of 3
	Brokk Bucket			$9,525	A total of 3
	Brokk Grapple Attachment			$96,300	A total of 3
	Brokk Hammer Breaker			$59,880	A total of 3
	Brokk Saw Attachment			$219,645	A total of 3
	Brokk Scabbler			$149,670	A total of 3
	BROKK Shear Attachment			$232,140	A total of 3
	CCTV Typical System 2 x P/T/Z plus 2 x Fixed Cameras, Operator desk, Controller and 4 monitors			$513,000	A total of 6
	Control Center Trailer			$3,000,000	A total of 6
	Crew Duffing/Changing Trailer			$360,000	A total of 6
	Crew Van (Purchase)			$175,000	A total of 5
	Decontamination Trailer			$1,500,000	A total of 6
	Diesel Fuel			$0	
	Drum Cost (Open Head, 55 gal., Black)			$146,100	2,356 drums
	Drum Handling - DC-Powered Drum Transporter			$15,558	A total of 5
	Excavator (Small, Backhoe)			$80,000	A total of 1
	Excavator (UP 90 Base Unit)			$1,796,000	A total of 4
	Flat bed (5 ton trucks) (Purchase)			$520,000	A total of 4
	Forklift Purchased (large - 50K ton capable)			$934,999	A total of 2
	Forklift Purchased (med - 15K ton capable)			$360,000	A total of 3
	Gantry Crane for Perma-Con Structure			$27,023,825	A total of 6
	Gasoline			$0	
	Greenhouse/Tent Structure (Pipelines)			$158,135	3 greenhouse structures
	Heavy Duty Roller Conveyor			$3,092	A total of 6
	Industrial Scale for Trucks (40 foot)			$15,288	A total of 1
	Loader (Cat 980) Purchased			$1,700,654	A total of 2
	Mechanics Trucks (Purchase)			$108,000	A total of 2
	Office Trailer			$455,000	A total of 13

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.01**				**PREPARER: Steve Ferries**
WBS Title:	**Manage 200-CW-5 and 200-PW-1/3/6 Remediation**				**CAM: Patrick Baynes**
					Support/Review: Joseph Urquidi
	Perma-Con Containment Structure, 120' x 150' (includes lighting fixtures)			$29,833,555	Total of 5 more Perma-Con/Contamination Control Structures
	Perma-Con Structure Delivery, via 5 Trucks			$100,000	Total of 5 more Perma-Con/Contamination Control Structures
	Perma-Con, RPS Site Engineer to Oversee Assembly			$125,000	Total of 5 more Perma-Con/Contamination Control Structures
	Pickup (Purchase)			$450,000	A total of 15
	Portable Breathable Fresh Air Compressors			$7,800	A total of 3
	Rad Program Cost			$0	
	Scissor Jacks for Boxes & Drums			$30,000	A total of 2
	SLB2			$164,282	11 SLB2s
	Tarping Station			$360,000	A total of 1
	Training for Crews			$500,000	1 year of training
	Training for Crews			$500,000	0.5 x 1 year of training every 5 years, (assume .5 at 5 yrs and .5 at 10 yrs)
	Trucks to Haul Roll Offs (Purchase)			$2,343,319	A total of 8
	Water Misting Systems (Allotment)			$28,884	A total of 4
	Water Trucks - 4,000 Gallon Tank (Purchase)			$890,535	A total of 4
	Weather Enclosure (Delivery & Erection)			$120,000	Total of 6 weather enclosures
	Weather Enclosure 1			$15,600,000	Total of 6 weather enclosures
	200-Z-361 System				
	Glove Box 1			$212,768	
	Grout Station			$200,000	A total of 1
	Heavy Duty Roller Conveyor			$515	A total of 1
	Scaffolding, steel tubular, heavy duty shoring for elevated slab forms, 14'8" high			$15,544	A total of 116
	Scissor Jacks for Boxes & Drums			$15,000	A total of 1
	ODCs - (travel, materials, etc.)			$3,884,926	3% of Activity costs
	General and Administrative			$26,676,493	20% of subtotal
	Contingency			$46,683,864	AACE Class 3, 35%
	Total			**$206,742,824**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.01**				**PREPARER: Steve Ferries**
WBS Title:	**Manage 200-CW-5 and 200-PW-1/3/6 Remediation**				**CAM: Patrick Baynes**
					Support/Review: Joseph Urquidi
Activity ID:	**1.1.2.7**				
Activity Name:	Unrealized Risk Contigency (Schedule Margin - zero cost activity)				
Activity Description:	This activity added 8 months of contingency to the schedule based on the risk analysis. There is no cost oı				
Estimated Start Date:	Project Start + 426 weeks				
Duration (workdays):	111				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
	ODCs - (travel, materials, etc.)			$0	3% of Activity costs
	General and Administrative			$0	N/A
	Contingency			$0	N/A
	Total			**$0**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS: **1.01**

WBS Title: **Manage 200-CW-5 and 200-PW-1/3/6 Remediation**

PREPARER: Steve Ferries
CAM: Patrick Baynes
Support/Review: Joseph Urquidi

Activity ID:	**1.1.3**				
Activity Name:	Mobilize Remediation System for 200-CW-5 and 200-PW-1/3/6				
Activity Description: Mobilize Project (e.g., complete archeological, cultural, and ecological reviews; set up construction facilities, survey pipe lines and grade; complete ground-penetrating radar (GPR) and other subgrade investigations; decommission wells; locate and isolate utilities; install temporary utilities; isolate waste transfer lines; set up haul routes; set up traffic detours; install construction fences; set up container staging and preparation areas; set up assay equipment; and set up air monitoring system).					
Estimated Start Date:	Project Start + 318 weeks				
Duration (workdays):	368				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
	ODCs - (travel, materials, etc.)			$0	3% of Activity costs
	General and Administrative			$0	N/A
	Contingency			$0	N/A
	Total			**$0**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.01**				**PREPARER: Steve Ferries**
WBS Title:	**Manage 200-CW-5 and 200-PW-1/3/6 Remediation**				**CAM: Patrick Baynes** **Support/Review: Joseph Urquidi**
Activity ID:	**1.1.3.1**				
Activity Name:	Complete Ecological Review				
Activity Description: As required by applicable or relevant and appropriate requirements (ARAR), the ecological reviews will be completed prior to initiation of fieldwork					
Estimated Start Date:	Project Start + 318 weeks				
Duration (workdays):	8				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
E050	Environmental Engineers	80	$6,226		Perform ecological review assume the crew is working full time
P090	Industrial Hygienists	80	$7,913		Complete Ecological Review
	ODCs - (travel, materials, etc.)			$424	3% of Activity costs
	General and Administrative			$2,913	20% of subtotal
	Contingency			$2,185	AACE Class 3, 15%
	Total			**$19,661**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.01**				**PREPARER: Steve Ferries**
WBS Title:	**Manage 200-CW-5 and 200-PW-1/3/6 Remediation**				**CAM: Patrick Baynes**
					Support/Review: Joseph Urquidi
Activity ID:	**1.1.3.2**				
Activity Name:	Locate and Isolate Utilities				
Activity Description:	Support facilities will be set up and made available for the project staff to perform their work				
Estimated Start Date:	Project Start + 320 weeks				
Duration (workdays):	48				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 3	Mobilization Crew	480	$652,839		0
	ODCs - (travel, materials, etc.)			$19,585	3% of Activity costs
	General and Administrative			$134,485	20% of subtotal
	Contingency			$100,864	AACE Class 3, 15%
	Total			**$907,773**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.01**				**PREPARER: Steve Ferries**
WBS Title:	**Manage 200-CW-5 and 200-PW-1/3/6 Remediation**				**CAM: Patrick Baynes**
					Support/Review: Joseph Urquidi
Activity ID:	**1.1.3.3**				Setup security fence
Activity Name:	Install Temporary Utilities				
Activity Description:	Existing utilities will be located and isolated to avoid inadvertent disruption due to project activities.				
Estimated Start Date:	Project Start + 332 weeks				
Duration (workdays):	48				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 3	Mobilization Crew	480	$652,839		
	ODCs - (travel, materials, etc.)			$19,585	3% of Activity costs
	General and Administrative			$134,485	20% of subtotal
	Contingency			$100,864	AACE Class 3, 15%
	Total			**$907,773**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.01**				**PREPARER: Steve Ferries**
WBS Title:	**Manage 200-CW-5 and 200-PW-1/3/6 Remediation**				**CAM: Patrick Baynes**
					Support/Review: Joseph Urquidi
Activity ID:	**1.1.3.4**				
Activity Name:	Set up Facilities				
Activity Description:	Temporary power, water, communications, or other resources that will be necessary for executing the remedial actions.				
Estimated Start Date:	Project Start + 344 weeks				
Duration (workdays):	48				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 3	Mobilization Crew	480	$652,839		
	Chain Link Fabric, 6 ft. H x 50 ft. L			$257,503	
	Haul Roads			$914,074	
	ODCs - (travel, materials, etc.)			$54,732	3% of Activity costs
	General and Administrative			$375,830	20% of subtotal
	Contingency			$281,872	AACE Class 3, 15%
	Total			**$2,536,850**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.01**				**PREPARER: Steve Ferries**
WBS Title:	**Manage 200-CW-5 and 200-PW-1/3/6 Remediation**				**CAM: Patrick Baynes**
					Support/Review: Joseph Urquidi
Activity ID:	**1.1.3.5**				
Activity Name:	Locate and Isolate Waste Transfer Lines				
Activity Description:	Active waste transfer lines will be located and isolated to avoid inadvertent disruption due to project activities. Inactive waste transfer lines that cross the excavation footprint or barrier footprint will be isolatec				
Estimated Start Date:	Project Start + 356 weeks				
Duration (workdays):	96				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 3	Mobilization Crew	960	$1,305,678		
	ODCs - (travel, materials, etc.)			$39,170	3% of Activity costs
	General and Administrative			$268,970	20% of subtotal
	Contingency			$201,727	AACE Class 3, 15%
	Total			**$1,815,545**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.01**				**PREPARER: Steve Ferries**
WBS Title:	**Manage 200-CW-5 and 200-PW-1/3/6 Remediation**				**CAM: Patrick Baynes**
					Support/Review: Joseph Urquidi
Activity ID:	**1.1.3.6**				
Activity Name:	Decommission Wells				
Activity Description: Wells and boreholes within the project boundary will be evaluated to determine if they impact the excavation, barrier, or operations. Wells that impact the project will be decommissioned in accordance with applicable requirements. Active wells will be re-located as part of work package 1.4, Enhance Soil Cover, Install ET Barriers, and Demobilize Project.					
Estimated Start Date:	Project Start + 380 weeks				
Duration (workdays):	96				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
	Decommissioning Wells			$1,535,600	Decommission 87 wells in use
	Re-decommissioning Wells			$348,238	Re-decommission and file amended start cards: 399 wells
	ODCs - (travel, materials, etc.)			$56,515	3% of Activity costs
	General and Administrative			$388,071	20% of subtotal
	Contingency			$291,053	AACE Class 3, 15%
	Total			**$2,619,476**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.01**				**PREPARER: Steve Ferries**
WBS Title:	**Manage 200-CW-5 and 200-PW-1/3/6 Remediation**				**CAM: Patrick Baynes**
					Support/Review: Joseph Urquidi
Activity ID:	**1.1.3.7**				
Activity Name:	Set up Air Monitoring System				
Activity Description:	IH and radiological air monitoring systems will be set up and made operational prior to initiation of remedial actions.				
Estimated Start Date:	Project Start + 404 weeks				
Duration (workdays):	24				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
	Setup air monitoring system based on cost buildup			$1,822,509	
	Setup air monitoring system based on cost buildup			$396,000	8 dog house air monitoring systems for the entire project life (8 * 9 yrs = 72 * $5,500 = $397,808)
	ODCs - (travel, materials, etc.)			$66,555	3% of Activity costs
	General and Administrative			$457,013	20% of subtotal
	Contingency			$342,760	AACE Class 3, 15%
	Total			**$3,084,837**	

Workbook 2

Remove, Treat, and Dispose Contaminated Soil and Debris

This page intentionally left blank.

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**		**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**		**CAM: Patrick Baynes**

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2**				
Activity Name:	Remove, Treat, and Dispose of Contaminated Soil and Debris				
Activity Description: Remove, Treat, and Dispose Contaminated Soil and Debris from the 200-CW-5, 200-PW-1, and 200-PW-6 Operable Units includes management and operations of the soil and debris remediation system after it is turned over to Operations.					
Estimated Start Date:	Project Start + 454 weeks				
Duration (workdays):	1845				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
	ODCs - (travel, materials, etc.)			$0	3% of Activity costs
	General and Administrative			$0	N/A
	contingency			$0	N/A
	Total			**$0**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS: **1.02** **PREPARER: Steve Ferries**

WBS Title: Remove, Treat, and Dispose Contaminated Soil and Debris **CAM: Patrick Baynes**

Activity ID:	**1.2.1**				
Activity Name:	Manage RTD of Contaminated Soil and Debris				

Activity Description: This activity provides day to day direction for RTD of the soil and debris. It includes the following:

- Manage the waste sites after turnover of the sites from the current custodian until turnover to the custodian(s) for either installing ET Barriers or institutional control of the sites.
- Provide maintenance and ownership of the authorization bases documents (e.g., documented safety analyses and air permits) required for operations and maintenance at the site during the period of management ownership.
- Review and approve project documentation developed during the period of management ownership that affects settling tank work sites (e.g., safety bases development and implementation, and operating procedures).
- Manage Operations, Maintenance and Work Control, Engineering, and RadCon.
- Maintain the remediation system.
- Provide engineering support, performance assurance and corrective action coordinator, Environmental Compliance Officer, Material Coordinator, training, emergency preparedness, industrial safety, nuclear and criticality safety, transportation safety, and QA.

Estimated Start Date:	Project Start + 454 weeks				
Duration (workdays):	1844				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 2	Operations Management & Support Crew	18440	$54,788,467		
	ODCs - (travel, materials, etc.)			$1,643,654	3% of Activity costs
	General and Administrative			$11,286,424	20% of subtotal
	contingency			$16,929,636	AACE class 3, 30%
	Total			**$84,648,182**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**	**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**	**CAM: Patrick Baynes**

Activity ID:	**1.2.2**				
Activity Name:	RTD of Soil and Debris from Z Ditches				
Activity Description:	This is a summary of the following activities with identification numbers starting with 1.2.2.				
Estimated Start Date:	Project Start + 454 weeks				
Duration (workdays):	1086				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
	ODCs - (travel, materials, etc.)			$0	3% of Activity costs
	General and Administrative			$0	N/A
	contingency			$0	N/A
	Total			**$0**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**

Activity ID:	**1.2.2.1**				
Activity Name:	Prepare to RTD of Z Ditches				

Activity Description: Prepare to remove contaminated soil and debris includes the following:
- Design excavation.
- Survey and stakeout excavation.
- Stabilize excavation areas with cave-in or subsidence potential.
- Remove structures or debris.
- Clear and grub excavation area.
- Grade field (prepare for work).
- Remove overburden pending use for backfill or dust control.
- Position weather enclosure over the excavation area.
- If required for radiological control (assumed to be areas with TRU contamination levels greater than 5 nCi/g) locate and assemble Contamination Control Structure over the excavation area.
- Verify ventilation system in-place and operating.
- Prepare containers.

Estimated Start Date:	Project Start + 454 weeks				
Duration (workdays):	1034				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 3	Mobilization Crew	1034	$1,406,324		Mobilization crew is used 10% of the time
Crew 5	Overburden Crew	1034	$812,376		Crew 5 is used 10% of time
Crew 6	WE/CCS Setup Crew	6721	$14,735,611		WE/CCS Setup crew is used 65% of the time
	Refueling of equipment			$14,890	
	Maintenance Charge			$10,000	
	ODCs - (travel, materials, etc.)			$509,376	3% of Activity costs
	General and Administrative			$3,497,715	20% of subtotal
	contingency			$5,246,573	AACE class 3, 30%
	Total			**$26,232,864**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.2.2**				
Activity Name:	Remove 200-W-207-PL				
Activity Description: Remove 200-W-207-PL includes: • Locate and isolate pipeline. • Remove overburden. • Excavate to expose pipeline. • Remove pipeline. • Separate TRU from LLW. • Package for either ERDF or WIPP disposal. • Move packaged waste to staging area. • Sample excavated area per SAP. • Pad in enough fill for contamination control. • When authorized by DOE-RL and EPA, backfill excavated area.					
Estimated Start Date:	Project Start + 454 weeks				
Duration (workdays):	48				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 4	Pipeline Excavation Crew	480	$607,943		
Crew 11	Waste Relocation Crew	480	$616,003		
Crew 15	Sampling Crew	480	$210,878		
	Verification samples (207-PL) - 14 samples			$25,780	
	Greenhouse subsequent use			$299,218	89 cuts in pipeline, assume move structure 89 times
	9x5x5 container liners			$1,000	20 container liners
	Fuel charge			$6,912	
	Maintenance Charge			$5,000	
	ODCs - (travel, materials, etc.)			$53,182	3% of Activity costs
	General and Administrative			$365,183	20% of subtotal
	contingency			$547,775	AACE class 3, 30%
	Total			**$2,738,873**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**	**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**	**CAM: Patrick Baynes**

Activity ID:	**1.2.2.3**				
Activity Name:	Remove 200-W-178-PL				
Activity Description: Remove 200-W-178-PL includes: • Locate and isolate pipeline. • Remove overburden. • Excavate to expose pipeline. • Remove pipeline. • Separate TRU from LLW. • Package for either ERDF or WIPP disposal. • Move packaged waste to staging area. • Sample excavated area per SAP. • Pad in enough fill for contamination control. • When authorized by DOE-RL and EPA, backfill excavated area.					
Estimated Start Date:	Project Start + 466 weeks				
Duration (workdays):	48				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 4	Pipeline Excavation Crew	480	$607,943		
Crew 11	Waste Relocation Crew	480	$616,003		
Crew 15	Sampling Crew	480	$210,878		
	Verification samples (178-PL) - 14 samples			$25,780	
	Greenhouse subsequent use			$285,770	85 cuts in pipeline. Assume 85 moves of the greenhouse structure
	SLB2			$30,000	2 SLB2's
	Refueling of equipment			$6,912	
	Maintenance Charge			$5,000	
	ODCs - (travel, materials, etc.)			$53,649	3% of Activity costs
	General and Administrative			$368,387	20% of subtotal
	contingency			$552,580	AACE class 3, 30%
	Total			**$2,762,901**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.2.4**				
Activity Name:	RTD of <5 nCi TRU per gram of waste from Z-1D North Ditch and Z-20				
Activity Description: Remove, treat, and dispose soil and debris with < 5 nCi/g TRU includes: • Remove structures or debris and prepare for ERDF disposal. • Remove soil and prepare for ERDF disposal. • Move packaged waste to staging area. • Sample excavated waste sites per SAP. • Pad in enough fill for contamination control					
Estimated Start Date:	Project Start + 478 weeks				
Duration (workdays):	227				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 8	Excavation Crew (<5 nCi TRU per gram of waste)	2270	$2,436,616		Includes liner costs
Crew 15	Sampling Crew	2270	$997,279		
	RO container liners			$163,491	3,270 container liners
	216-Z1D North (172 samples)			$316,721	
	Fuel charge			$32,688	
	Maintenance Charge			$15,000	
	ODCs - (travel, materials, etc.)			$118,854	3% of Activity costs
	General and Administrative			$816,130	20% of subtotal
	contingency			$1,224,195	AACE class 3, 30%
	Total			**$6,120,973**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.2.5**				
Activity Name:	RTD of >5 nCi TRU per gram of waste from UPR, Z-11, Z-19, and Z-1D South				
Activity Description: Remove, treat, and dispose soil and debris with > 5 nCi/g TRU includes: • Remove structures or debris. • Separate TRU from LLW. • Package debris for either ERDF or WIPP disposal. • Move packaged waste to staging area. • Remove soil. • Separate TRU from LLW. • Package for either ERDF or WIPP disposal. • Move packaged waste to staging area					
Estimated Start Date:	Project Start + 534 weeks				
Duration (workdays):	174				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 7	Excavation Crew (>5 nCi TRU per gram of waste)	1740	$1,934,556		
Crew 11	Waste Relocation Crew	1740	$2,233,009		
	WIPP Drums			$147,905	2,386 wipp drums
	9x5x5 container liners			$29,754	595 liners
	Fuel charge			$25,056	
	Maintenance Charge			$10,000	
	ODCs - (travel, materials, etc.)			$131,408	3% of Activity costs
	General and Administrative			$902,338	20% of subtotal
	contingency			$1,353,507	AACE class 3, 30%
	Total			**$6,767,533**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.2.6**				
Activity Name:	RTD of <5 nCi TRU per gram of waste from UPR, Z-11, Z-19, Z-1D South				
Activity Description: Remove, treat, and dispose soil and debris with < 5 nCi/g TRU includes: • Remove structures or debris and prepare for ERDF disposal. • Remove soil and prepare for ERDF disposal. • Move packaged waste to staging area. • Sample excavated waste sites per SAP. • Pad in enough fill for contamination control					
Estimated Start Date:	Project Start + 578 weeks				
Duration (workdays):	537				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 8	Excavation Crew (<5 nCi TRU per gram of waste)	5370	$5,764,153		
Crew 15	Sampling Crew	5370	$2,359,202		
	216-Z1D South (14 samples)			$25,780	8 samples
	RO container liners			$1,030,332	20,607 liners
	Fuel charge			$77,328	
	Maintenance Charge			$30,000	
	ODCs - (travel, materials, etc.)			$278,604	3% of Activity costs
	General and Administrative			$1,913,080	20% of subtotal
	contingency			$2,869,619	AACE class 3, 30%
	Total			**$14,348,097**	20,607 Total

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**		**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**		**CAM: Patrick Baynes**

Activity ID:	**1.2.2.7**				20,607 5
Activity Name:	Ship TRU to CWC				
Activity Description: Ship TRU waste to CWC includes: • Confirm that waste is TRU. • Prepare shipping documentation. • Load waste on truck (208 L [55 gallon] drums, SWBs, or SLB2s). • Transport waste to CWC. • This task includes the CWC Receipt Fee and 10 years of CWC storage cost					
Estimated Start Date:	Project Start + 534 weeks				
Duration (workdays):	174				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 12	Process Area Crew	870	$1,033,672		Crew 12 is used 50% of the time
Crew 13	Ship to CWC	1740	$1,558,393		
	NDA Daily Lease			$815,625	174 days of NDA system lease
	CWC Cost			$1,313,329	159 shipments
	ODCs - (travel, materials, etc.)			$141,631	3% of Activity costs
	General and Administrative			$972,530	20% of subtotal
	contingency			$1,458,795	AACE class 3, 30%
	Total			**$7,293,974**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.2.8**				
Activity Name:	Dispose of LLW at ERDF (ERDF Disposal Fee)				
Activity Description: Dispose LLW at ERDF includes: • Confirm that waste is LLW. • Prepare shipping documentation. • Load waste on truck (2.7 x 1.5 x 1.5 m [9 x 5 x 5 ft] boxes). • Transport waste to ERDF. • This task includes the ERDF disposal fee					
Estimated Start Date:	Project Start + 454 weeks				
Duration (workdays):	1038				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 12	Process Area Crew	5190	$6,166,390		Crew 12 is used 50% of time
Crew 14	Ship to ERDF	10380	$10,910,150		
	NDA Daily Lease			$4,865,625	1038 days of NDA system lease
	ERDF Disposal cost per M3			$19,500,364	171,056 m3
	ODCs - (travel, materials, etc.)			$1,243,276	3% of Activity costs
	General and Administrative			$8,537,161	20% of subtotal
	contingency			$12,805,741	AACE class 3, 30%
	Total			**$64,028,707**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.2.9**				
Activity Name:	Backfill and revegetate Z Ditches				
Activity Description: This activity includes: • Confirm sample results. • When authorized by DOE-RL and EPA, backfill excavated waste sites. • revegetate 216-Z-1D Ditch, 216-Z-11 Ditch, 216-Z-19 Ditch, 216-Z-20 Tile Field, and UPR-200-W-110.					
Estimated Start Date:	Project Start + 713 weeks				
Duration (workdays):	48				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 16	Backfill and soil cover crew	480	$580,598		
	Revegetate Area (per acre)			$24,237	4.84 acres
	Fuel charge			$6,912	
	Maintenance Charge			$5,000	
	ODCs - (travel, materials, etc.)			$18,502	3% of Activity costs
	General and Administrative			$127,050	20% of subtotal
	contingency			$190,575	AACE class 3, 30%
	Total			**$952,875**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**	**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**	**CAM: Patrick Baynes**

Activity ID:	**1.2.3**				
Activity Name:	RTD of Soil and Debris from 216-Z-5				
Activity Description:	This is a summary of the following activities with identification numbers starting with 1.2.3.				
Estimated Start Date:	Project Start + 712 weeks				
Duration (workdays):	46				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
	ODCs - (travel, materials, etc.)			$0	3% of Activity costs
	General and Administrative			$0	N/A
	contingency			$0	N/A
	Total			**$0**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.3.1**				
Activity Name:	Prepare to RTD of 216-Z-5				
Activity Description: Prepare to remove contaminated soil and debris includes the following: • Design excavation. • Survey and stakeout excavation. • Stabilize excavation areas with cave-in or subsidence potential. • Remove structures or debris. • Clear and grub excavation area. • Grade field (prepare for work). • Remove overburden pending use for backfill or dust control. • Position weather enclosure over the excavation area. • If required for radiological control (assumed to be areas with TRU contamination levels greater than 5 nCi/g) locate and assemble Contamination Control Structure (CCS) over the excavation area. • Verify ventilation system in-place and operating. • Prepare containers.					
Estimated Start Date:	Project Start + 712 weeks				
Duration (workdays):	28				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 3	Mobilization Crew	28	$38,082		Mobilization crew is used 10% of the time
Crew 5	Overburden Crew	28	$21,999		Crew 5 is used 10% of time
Crew 6	WE/CCS Setup Crew	280	$613,892		WE/CCS Setup crew is used 100% of the time
	Fuel charge			$403	
	Maintenance Charge			$5,000	
	ODCs - (travel, materials, etc.)			$20,381	3% of Activity costs
	General and Administrative			$139,952	20% of subtotal
	contingency			$209,927	AACE class 3, 30%
	Total			**$1,049,637**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**		**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**		**CAM: Patrick Baynes**

Activity ID:	**1.2.3.2**				
Activity Name:	RTD of >5 nCi TRU per gram of waste from 216-Z-5				
Activity Description: Remove, treat, and dispose soil and debris with > 5 nCi/g TRU includes: • Remove structures or debris: - Separate TRU from LLW - Package debris for either ERDF or WIPP disposal - Move packaged waste to staging area. • Remove soil: - Separate TRU from LLW - Package for either ERDF or WIPP disposal - Move packaged waste to staging area					
Estimated Start Date:	Project Start + 712 weeks				
Duration (workdays):	10				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 7	Excavation Crew (>5 nCi TRU per gram of waste)	100	$111,181		
Crew 11	Waste Relocation Crew	100	$128,334		
	WIPP Drums			$1,967	32 drums
	9x5x5 container liners			$50	1 liner
	Fuel charge			$1,440	
	Maintenance Charge			$5,000	
	ODCs - (travel, materials, etc.)			$7,439	3% of Activity costs
	General and Administrative			$51,082	20% of subtotal
	contingency			$76,623	AACE class 3, 30%
	Total			**$383,117**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.3.3**				
Activity Name:	RTD of <5 nCi TRU per gram of waste from 216-Z-5				
Activity Description: Remove, treat, and dispose soil and debris with < 5 nCi/g TRU includes: • Remove structures or debris and prepare for ERDF disposal. • Remove soil and prepare for ERDF disposal. • Move packaged waste to staging area. • Sample excavated waste sites per SAP. • Pad in enough fill for contamination control					
Estimated Start Date:	Project Start + 715 weeks				
Duration (workdays):	10				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 8	Excavation Crew (<5 nCi TRU per gram of waste)	100	$107,340		
Crew 15	Sampling Crew	100	$43,933		
	216-Z-5 (14 samples)			$13,860	
	216-Z-5 (1 deep sample)			$15,000	
	RO container liners			$15,943	319 liners
	Fuel charge			$1,440	
	Maintenance Charge			$5,000	
	ODCs - (travel, materials, etc.)			$6,075	3% of Activity costs
	General and Administrative			$41,718	20% of subtotal
	contingency			$62,577	AACE class 3, 30%
	Total			**$312,886**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.3.4**				
Activity Name:	Ship TRU to CWC				
Activity Description: Ship TRU waste to CWC includes: • Confirm that waste is TRU. • Prepare shipping documentation. • Load waste on truck (208 L [55 gallon] drums, SWBs, or SLB2s). • Transport waste to CWC. • This task includes the CWC Receipt Fee and 10 years of CWC storage cost					
Estimated Start Date:	Project Start + 712 weeks				
Duration (workdays):	20				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 12	Process Area Crew	100	$118,813		Crew 12 is used 50% of time
Crew 13	Ship to CWC	200	$179,126		
	NDA Daily Lease			$93,750	20 days of NDA system lease
	CWC Cost			$323,261	2 shipments
	ODCs - (travel, materials, etc.)			$21,448	3% of Activity costs
	General and Administrative			$147,280	20% of subtotal
	contingency			$220,919	AACE class 3, 30%
	Total			**$1,104,597**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.3.5**				
Activity Name:	Dispose of LLW at ERDF (ERDF Disposal Fee)				
Activity Description: Dispose LLW at ERDF includes: • Confirm that waste is LLW. • Prepare shipping documentation. • Load waste on truck (2.7 x 1.5 x 1.5 m [9 x 5 x 5 ft] boxes). • Transport waste to ERDF. • This task includes the ERDF disposal fee					
Estimated Start Date:	Project Start + 715 weeks				
Duration (workdays):	20				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 12	Process Area Crew	100	$118,813		Crew 12 is used 50% of time
Crew 14	Ship to ERDF	200	$210,215		
	ERDF Disposal cost per M3			$255,167	2,238 m3
	NDA Daily Lease			$93,750	20 days of NDA system lease
	ODCs - (travel, materials, etc.)			$20,338	3% of Activity costs
	General and Administrative			$139,657	20% of subtotal
	contingency			$209,485	AACE class 3, 30%
	Total			**$1,047,424**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.3.6**				
Activity Name:	Backfill 216-Z-5				
Activity Description: Backfill includes: • Confirm sample results. • When authorized by DOE-RL and EPA, backfill excavated waste sites.					
Estimated Start Date:	Project Start + 720 weeks				
Duration (workdays):	16				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 16	Backfill and soil cover crew	160	$193,533		
	Fuel charge			$2,304	
	Maintenance Charge			$5,000	
	Revegetate Area (per acre)			$706	0.14 acres
	ODCs - (travel, materials, etc.)			$6,046	3% of Activity costs
	General and Administrative			$41,518	20% of subtotal
	contingency			$62,277	AACE class 3, 30%
	Total			**$311,384**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**		**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**		**CAM: Patrick Baynes**

Activity ID:	**1.2.4**				
Activity Name:	RTD of Soil and Debris from 216-Z-18				
Activity Description:	This is a summary of the following activities with identification numbers starting with 1.2.4.				
Estimated Start Date:	Project Start + 717 weeks				
Duration (workdays):	347				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
	ODCs - (travel, materials, etc.)			$0	3% of Activity costs
	General and Administrative			$0	N/A
	contingency			$0	N/A
	Total			**$0**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS: **1.02** **PREPARER: Steve Ferries**

WBS Title: Remove, Treat, and Dispose Contaminated Soil and Debris **CAM: Patrick Baynes**

Activity ID:	**1.2.4.1**				
Activity Name:	Prepare to RTD of 216-Z-18				
Activity Description: Prepare to remove contaminated soil and debris includes the following: • Design excavation. • Survey and stakeout excavation. • Stabilize excavation areas with cave-in or subsidence potential. • Remove structures or debris. • Clear and grub excavation area. • Grade field (prepare for work). • Remove overburden pending use for backfill or dust control. • Position weather enclosure over the excavation area. • If required for radiological control (assumed to be areas with TRU contamination levels greater than 5 nCi/g) locate and assemble Contamination Control Structure over the excavation area. • Verify ventilation system in-place and operating. • Prepare containers.					
Estimated Start Date:	Project Start + 717 weeks				
Duration (workdays):	331				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 3	Mobilization Crew	331	$450,187		Mobilization crew is used 10% of the time
Crew 5	Overburden Crew	331	$260,054		Overburden crew is used 10% of the time
Crew 6	WE/CCS Setup Crew	1655	$3,628,543		WE/CCS Setup crew is used 50% of the time
	Fuel charge			$4,766	
	Maintenance Charge			$5,000	
	ODCs - (travel, materials, etc.)			$130,457	3% of Activity costs
	General and Administrative			$895,801	20% of subtotal
	contingency			$1,343,702	AACE class 3, 30%
	Total			**$6,718,511**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.4.2**				
Activity Name:	RTD of >5 nCi TRU per gram of waste from 216-Z-18				
Activity Description: Remove, treat, and dispose soil and debris with > 5 nCi/g TRU includes: • Remove structures or debris. • Separate TRU from LLW. • Package debris for either ERDF or WIPP disposal. • Move packaged waste to staging area. • Remove soil. • Separate TRU from LLW. • Package for either ERDF or WIPP disposal. • Move packaged waste to staging area.					
Estimated Start Date:	Project Start + 717 weeks				
Duration (workdays):	320				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 7	Excavation Crew (>5 nCi TRU per gram of waste)	3200	$3,557,805		
Crew 11	Waste Relocation Crew	3200	$4,106,684		
	WIPP Drums			$363,362	5,861 wipp drums
	9x5x5 container liners			$9,200	184 liners
	Fuel charge			$46,080	
	Maintenance Charge			$20,000	
	ODCs - (travel, materials, etc.)			$243,094	3% of Activity costs
	General and Administrative			$1,669,245	20% of subtotal
	contingency			$2,503,867	AACE class 3, 30%
	Total			**$12,519,337**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.4.3**				
Activity Name:	RTD of <5 nCi TRU per gram of waste from 216-Z-18				
Activity Description: Remove, treat, and dispose soil and debris with < 5 nCi/g TRU includes: • Remove structures or debris and prepare for ERDF disposal. • Remove soil and prepare for ERDF disposal. • Move packaged waste to staging area. • Sample excavated waste sites per SAP. • Pad in enough fill for contamination control					
Estimated Start Date:	Project Start + 797 weeks				
Duration (workdays):	11				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 8	Excavation Crew (<5 nCi TRU per gram of waste)	110	$118,074		
Crew 15	Sampling Crew	110	$48,326		
	216-Z-18 (53 samples)			$52,470	
	216-Z-18 (4 deep samples)			$60,000	
	RO container liners			$17,347	347 liners
	Fuel charge			$1,584	
	Maintenance Charge			$5,000	
	ODCs - (travel, materials, etc.)			$9,084	3% of Activity costs
	General and Administrative			$62,377	20% of subtotal
	contingency			$93,566	AACE class 3, 30%
	Total			**$467,828**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.4.4**				
Activity Name:	Ship TRU to CWC				
Activity Description: Ship TRU waste to CWC includes: • Confirm that waste is TRU. • Prepare shipping documentation. • Load waste on truck (208 L [55 gallon] drums, SWBs, or SLB2s). • Transport waste to CWC. • This task includes the CWC Receipt Fee and 10 years of CWC storage cost					
Estimated Start Date:	Project Start + 717 weeks				
Duration (workdays):	320				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 12	Process Area Crew	1600	$1,901,006		Crew 12 working at 50% of the time.
Crew 13	Ship to CWC	3200	$2,866,010		
	NDA Daily Lease			$1,500,000	320 days of NDA system lease
	CWC Cost			$9,679,492	280 shipments
	ODCs - (travel, materials, etc.)			$478,395	3% of Activity costs
	General and Administrative			$3,284,981	20% of subtotal
	contingency			$4,927,471	AACE class 3, 30%
	Total			**$24,637,355**	

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.4.5**				
Activity Name:	Dispose of LLW at ERDF (ERDF Disposal Fee)				
Activity Description: Dispose LLW at ERDF includes: • Confirm that waste is LLW. • Prepare shipping documentation. • Load waste on truck (2.7 x 1.5 x 1.5 m [9 x 5 x 5 ft] boxes). • Transport waste to ERDF. • This task includes the ERDF disposal fee					
Estimated Start Date:	Project Start + 797 weeks				
Duration (workdays):	11				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 12	Process Area Crew	55	$65,347		Crew 12 working at 50% of the time.
Crew 14	Ship to ERDF	110	$115,618		
	NDA Daily Lease			$51,563	11 days of NDA system lease
	ERDF Disposal cost per M3			$410,482	3,601 m3
	ODCs - (travel, materials, etc.)			$19,290	3% of Activity costs
	General and Administrative			$132,460	20% of subtotal
	contingency			$198,690	AACE class 3, 30%
	Total			**$993,450**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.4.6**				
Activity Name:	Backfill 216-Z-18				
Activity Description: Sample and backfill includes: • Pad in enough fill for contamination control. • When authorized by DOE-RL and EPA, backfill excavated waste sites.					
Estimated Start Date:	Project Start + 800 weeks				
Duration (workdays):	16				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 16	Backfill and soil cover crew	160	$193,533		
	Fuel charge			$2,304	
	Maintenance Charge			$5,000	
	Revegetate Area (per acre)			$6,386	
	ODCs - (travel, materials, etc.)			$6,217	3% of Activity costs
	General and Administrative			$42,688	20% of subtotal
	contingency			$64,032	AACE class 3, 30%
	Total			**$320,159**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**	**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**	**CAM: Patrick Baynes**

Activity ID:	**1.2.5**				
Activity Name:	RTD of Soil and Debris from 216-Z-9				
Activity Description:	This is a summary of the following activities with identification numbers starting with 1.2.5.				
Estimated Start Date:	Project Start + 454 weeks				
Duration (workdays):	378				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
	ODCs - (travel, materials, etc.)			$0	3% of Activity costs
	General and Administrative			$0	N/A
	contingency			$0	N/A
	Total			**$0**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.5.1**				
Activity Name:	Prepare to RTD of 216-Z-9				

Activity Description: Prepare to remove contaminated soil and debris includes the following:
• Sample excavated waste sites per the Sample Analysis Plan.
• Design excavation.
• Survey and stakeout excavation.
• Stabilize excavation areas with cave-in or subsidence potential.
• Remove structures or debris.
• Clear and grub excavation area.
• Grade field (prepare for work).
• Remove overburden pending use for backfill or dust control.
• Position weather enclosure over the excavation area.
• If required for radiological control (assumed to be areas with TRU contamination levels greater than 5 nCi/g) locate and assemble Contamination Control Structure over the excavation area.
• Verify ventilation system in-place and operating.
• Prepare containers.

Estimated Start Date:	Project Start + 454 weeks				
Duration (workdays):	362				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 3	Mobilization Crew	181	$246,175		Mobilization crew is used 5% of the time
Crew 5	Overburden Crew	181	$142,205		Overburden crew is used 5% of the time
Crew 6	WE/CCS Setup Crew	181	$396,838		WE/CCS Setup crew is used 5% of the time
	Fuel charge			$2,606	
	Maintenance Charge			$5,000	
	ODCs - (travel, materials, etc.)			$23,785	3% of Activity costs
	General and Administrative			$163,322	20% of subtotal
	contingency			$244,983	AACE class 3, 30%
	Total			**$1,224,913**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS: **1.02** | **PREPARER: Steve Ferries**

WBS Title: Remove, Treat, and Dispose Contaminated Soil and Debris | **CAM: Patrick Baynes**

Activity ID:	**1.2.5.2**				
Activity Name:	Remove 200-W-206-PL				

Activity Description: Remove 200-W-206-PL includes:
- Locate and isolate pipeline.
- Remove overburden.
- Excavate to expose pipeline.
- Remove pipeline.
- Separate TRU from LLW.
- Package for either ERDF or WIPP disposal.
- Move packaged waste to staging area.
- Sample excavated area per SAP.
- Pad in enough fill for contamination control.
- When authorized by DOE-RL and EPA, backfill excavated area.

Estimated Start Date:	Project Start + 454 weeks				
Duration (workdays):	48				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 4	Pipeline Excavation Crew	480	$607,943		
Crew 11	Waste Relocation Crew	480	$616,003		
Crew 15	Sampling Crew	480	$210,878		
	Verification samples (206-PL) - 14 samples			$25,780	
	Greenhouse subsequent use			$184,910	54 cuts in pipe and 1 diversion box. Assume 55 moves of the greenhouse structure.
	SLB2			$15,000	1 SLB2
	Fuel charge			$6,912	
	Maintenance Charge			$5,000	
	ODCs - (travel, materials, etc.)			$50,173	3% of Activity costs
	General and Administrative			$344,520	20% of subtotal
	contingency			$516,779	AACE class 3, 30%
	Total			**$2,583,897**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.5.3**				
Activity Name:	Remove 216-Z-9 Structures and Stabilize Site				
Activity Description: Remove,216-Z-9 structures and stabilize site includes: • Remove above grade structures or debris, including the glovebox, associated equipment, and building. • Separate TRU from LLW. • Package for either ERDF or WIPP disposal. • Move packaged waste to staging area.					
Estimated Start Date:	Project Start + 466 weeks				
Duration (workdays):	216				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 5	Overburden Crew	2160	$1,697,032		
Crew 8	Excavation Crew (<5 nCi TRU per gram of waste)	2160	$2,318,542		
Crew 11	Waste Relocation Crew	2160	$2,772,012		
	RO container liners			$5,000	100 RO liners
	Refueling of equipment			$62,208	
	Maintenance Charge			$15,000	
	ODCs - (travel, materials, etc.)			$206,094	3% of Activity costs
	General and Administrative			$1,415,177	20% of subtotal
	contingency			$2,122,766	AACE class 3, 30%
	Total			**$10,613,831**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.5.4**				
Activity Name:	RTD of >5 nCi TRU per gram of waste from 216-Z-9				
Activity Description: Remove, treat, and dispose soil and debris with > 5 nCi/g TRU includes: • Remove structures or debris. • Separate TRU from LLW. • Package debris for either ERDF or WIPP disposal. • Move packaged waste to staging area. • Remove soil. • Separate TRU from LLW. • Package for either ERDF or WIPP disposal. • Move packaged waste to staging area.					
Estimated Start Date:	Project Start + 520 weeks				
Duration (workdays):	46				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 7	Excavation Crew (>5 nCi TRU per gram of waste)	460	$511,434		Includes container costs
Crew 11	Waste Relocation Crew	460	$590,336		
	WIPP Drums			$39,806	642 wipp drums
	9x5x5 container liners			$8,063	161 liners
	Fuel charge			$6,624	
	Maintenance Charge			$5,000	
	ODCs - (travel, materials, etc.)			$34,838	3% of Activity costs
	General and Administrative			$239,220	20% of subtotal
	contingency			$358,830	AACE class 3, 30%
	Total			**$1,794,152**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.5.5**				
Activity Name:	RTD of <5 nCi TRU per gram of waste from 216-Z-9				
Activity Description: Remove, treat, and dispose soil and debris with < 5 nCi/g TRU includes: • Remove structures or debris and prepare for ERDF disposal. • Remove soil and prepare for ERDF disposal. • Move packaged waste to staging area. • Sample excavated waste sites per SAP. • Pad in enough fill for contamination control					
Estimated Start Date:	Project Start + 531 weeks				
Duration (workdays):	52				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 5	Overburden Crew	520	$408,545		
Crew 8	Excavation Crew (<5 nCi TRU per gram of waste)	520	$558,167		
Crew 15	Sampling Crew	520	$228,452		
	RO container liners			$74,661	1,493 liners
	Fuel charge			$7,488	
	Maintenance Charge			$5,000	
	216-Z-9 (14 samples)			$13,860	
	216-Z-9 (1 deep sample)			$15,000	
	ODCs - (travel, materials, etc.)			$39,335	3% of Activity costs
	General and Administrative			$270,102	20% of subtotal
	contingency			$405,152	AACE class 3, 30%
	Total			**$2,025,761**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**	**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**	**CAM: Patrick Baynes**

Activity ID:	**1.2.5.6**				
Activity Name:	Ship TRU to CWC				
Activity Description: Ship TRU waste to CWC includes: • Confirm that waste is TRU. • Prepare shipping documentation. • Load waste on truck (208 L [55 gallon] drums, SWBs, or SLB2s). • Transport waste to CWC. • This task includes the CWC Receipt Fee and 10 years of CWC storage cost					
Estimated Start Date:	Project Start + 492 weeks				
Duration (workdays):	46				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 12	Process Area Crew	230	$273,270		Crew 12 is used 50% of the time.
Crew 13	Ship to CWC	460	$411,989		
	NDA Daily Lease			$215,625	46 days of NDA system lease
	CWC Cost			$1,085,161	32 shipments
	ODCs - (travel, materials, etc.)			$59,581	3% of Activity costs
	General and Administrative			$409,125	20% of subtotal
	contingency			$613,688	AACE class 3, 30%
	Total			**$3,068,439**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.5.7**				
Activity Name:	Dispose of LLW at ERDF (ERDF Disposal Fee)				
Activity Description: Dispose LLW at ERDF includes: • Confirm that waste is LLW. • Prepare shipping documentation. • Load waste on truck (2.7 x 1.5 x 1.5 m [9 x 5 x 5 ft] boxes). • Transport waste to ERDF. • This task includes the ERDF disposal fee					
Estimated Start Date:	Project Start + 454 weeks				
Duration (workdays):	362				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 12	Process Area Crew	1810	$2,150,514		Crew 12 is used 50% of time
Crew 14	Ship to ERDF	3620	$3,804,888		
	NDA Daily Lease			$1,696,875	362 days of NDA system lease
	ERDF Disposal cost per M3			$1,388,489	12,180 m3
	ODCs - (travel, materials, etc.)			$271,223	3% of Activity costs
	General and Administrative			$1,862,398	20% of subtotal
	contingency			$2,793,597	AACE class 3, 30%
	Total			**$13,967,984**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.5.8**				
Activity Name:	Backfill 216-Z-9				
Activity Description: Backfill includes: • Confirm sample results. • When authorized by DOE-RL and EPA, backfill excavated waste sites.					
Estimated Start Date:	Project Start + 544 weeks				
Duration (workdays):	16				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 16	Backfill and soil cover crew	160	$193,533		
	Fuel charge			$2,304	
	Maintenance Charge			$5,000	
	Revegetate Area (per acre)			$1,316	
	ODCs - (travel, materials, etc.)			$6,065	3% of Activity costs
	General and Administrative			$41,643	20% of subtotal
	contingency			$62,465	AACE class 3, 30%
	Total			**$312,326**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**	**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**	**CAM: Patrick Baynes**

Activity ID:	**1.2.6**				
Activity Name:	RTD of Soil and Debris from 216-Z-12				
Activity Description:	This is a summary of the following activities with identification numbers starting with 1.2.6.				
Estimated Start Date:	Project Start + 544 weeks				
Duration (workdays):	460				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
	ODCs - (travel, materials, etc.)			$0	3% of Activity costs
	General and Administrative			$0	N/A
	contingency			$0	N/A
	Total			**$0**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**	**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**	**CAM: Patrick Baynes**

Activity ID:	**1.2.6.1**				
Activity Name:	Prepare to RTD of 216-Z-12				

Activity Description: Prepare to remove contaminated soil and debris includes the following:

- Design excavation.
- Survey and stakeout excavation.
- Stabilize excavation areas with cave-in or subsidence potential.
- Remove structures or debris.
- Clear and grub excavation area.
- Grade field (prepare for work).
- Remove overburden pending use for backfill or dust control.
- Position weather enclosure over the excavation area.
- If required for radiological control (assumed to be areas with TRU contamination levels greater than 5 nCi/g) locate and assemble Contamination Control Structure over the excavation area.
- Verify ventilation system in-place and operating.
- Prepare containers.

Estimated Start Date:	Project Start + 544 weeks				
Duration (workdays):	444				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 3	Mobilization Crew	222	$301,938		Mobilization crew is used 5% of the time
Crew 5	Overburden Crew	222	$174,417		Overburden crew is used 5% of the time
Crew 6	WE/CCS Setup Crew	444	$973,458		WE/CCS Setup crew is used 10% of the time
	Fuel charge			$3,197	
	Maintenance Charge			$5,000	
	ODCs - (travel, materials, etc.)			$43,740	3% of Activity costs
	General and Administrative			$300,350	20% of subtotal
	contingency			$450,525	AACE class 3, 30%
	Total			**$2,252,625**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.6.2**				
Activity Name:	Remove 200-W-208-PL				
Activity Description: Remove 200-W-208-PL includes: • Locate and isolate pipeline. • Remove overburden. • Excavate to expose pipeline. • Remove pipeline. • Separate TRU from LLW. • Package for either ERDF or WIPP disposal. • Move packaged waste to staging area. • Sample excavated area per SAP. • Pad in enough fill for contamination control.					
Estimated Start Date:	Project Start + 544 weeks				
Duration (workdays):	48				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 4	Pipeline Excavation Crew	480	$607,943		
Crew 11	Waste Relocation Crew	480	$616,003		
Crew 15	Sampling Crew	480	$210,878		
	Verification samples (208-PL) -14 samples			$25,780	
	Greenhouse subsequent use			$127,756	38 cuts in pipe. Assume 38 moves of the greenhouse structure
	SLB2			$90,000	6 SLB2s
	Fuel charge			$6,912	
	Maintenance Charge			$5,000	
	ODCs - (travel, materials, etc.)			$50,708	3% of Activity costs
	General and Administrative			$348,196	20% of subtotal
	contingency			$522,294	AACE class 3, 30%
	Total			**$2,611,469**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.6.3**				
Activity Name:	RTD of >5 nCi TRU per gram of waste from 216-Z-12				
Activity Description: Remove, treat, and dispose soil and debris with > 5 nCi/g TRU includes: • Remove structures or debris. • Size reduce and remove glass block. • Separate TRU from LLW. • Package debris for either ERDF or WIPP disposal. • Move packaged waste to staging area. • Remove soil. • Separate TRU from LLW. • Package for either ERDF or WIPP disposal. • Move packaged waste to staging area.					
Estimated Start Date:	Project Start + 556 weeks				
Duration (workdays):	282				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 7	Excavation Crew (>5 nCi TRU per gram of waste)	2820	$3,135,316		
Crew 11	Waste Relocation Crew	2820	$3,619,015		
	WIPP Drums			$320,580	5,171 wipp drums
	9x5x5 container liners			$8,117	162 liners
	Fuel charge			$40,608	
	Maintenance Charge			$15,000	
	ODCs - (travel, materials, etc.)			$214,159	3% of Activity costs
	General and Administrative			$1,470,559	20% of subtotal
	contingency			$2,205,839	AACE class 3, 30%
	Total			**$11,029,193**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.6.4**				
Activity Name:	RTD of <5 nCi TRU per gram of waste from 216-Z-12				
Activity Description: Remove, treat, and dispose soil and debris with < 5 nCi/g TRU includes: • Remove structures or debris and prepare for ERDF disposal. • Remove soil and prepare for ERDF disposal. • Move packaged waste to staging area. • Sample excavated waste sites per SAP. • Pad in enough fill for contamination control					
Estimated Start Date:	Project Start + 627 weeks				
Duration (workdays):	114				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 5	Overburden Crew	1140	$895,656		
Crew 8	Excavation Crew (<5 nCi TRU per gram of waste)	1140	$1,223,675		
Crew 15	Sampling Crew	1140	$500,836		
	216-Z-12 (40 samples)			$39,600	
	216-Z-12 (3 deep samples)			$45,000	
	RO container liners			$175,523	3,510 liners
	Fuel charge			$16,416	
	Maintenance Charge			$10,000	
	ODCs - (travel, materials, etc.)			$87,201	3% of Activity costs
	General and Administrative			$598,781	20% of subtotal
	contingency			$898,172	AACE class 3, 30%
	Total			**$4,490,861**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.6.5**				
Activity Name:	Ship TRU to CWC				
Activity Description: Ship TRU waste to CWC includes: • Confirm that waste is TRU. • Prepare shipping documentation. • Load waste on truck (208 L [55 gallon] drums, SWBs, or SLB2s). • Transport waste to CWC. • This task includes the CWC Receipt Fee and 10 years of CWC storage cost					
Estimated Start Date:	Project Start + 544 weeks				
Duration (workdays):	282				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 12	Process Area Crew	1410	$1,675,262		Crew 12 is used 50% of the time.
Crew 13	Ship to CWC	2820	$2,525,671		
	NDA Daily Lease			$1,321,875	282 days of NDA system lease
	CWC Cost			$8,870,168	249 shipments
	ODCs - (travel, materials, etc.)			$431,789	3% of Activity costs
	General and Administrative			$2,964,953	20% of subtotal
	contingency			$4,447,430	AACE class 3, 30%
	Total			**$22,237,148**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.6.6**				
Activity Name:	Dispose of LLW at ERDF (ERDF Disposal Fee)				
Activity Description: Dispose LLW at ERDF includes: • Confirm that waste is LLW. • Prepare shipping documentation. • Load waste on truck (2.7 x 1.5 x 1.5 m [9 x 5 x 5 ft] boxes). • Transport waste to ERDF. • This task includes the ERDF disposal fee					
Estimated Start Date:	Project Start + 544 weeks				
Duration (workdays):	444				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 12	Process Area Crew	2220	$2,637,646		Crew 12 is used 50% of time
Crew 14	Ship to ERDF	4440	$4,666,769		
	NDA Daily Lease			$2,081,250	444 days of NDA system lease
	ERDF Disposal cost per M3			$2,919,241	25,607 m3
	ODCs - (travel, materials, etc.)			$369,147	3% of Activity costs
	General and Administrative			$2,534,811	20% of subtotal
	contingency			$3,802,216	AACE class 3, 30%
	Total			**$19,011,082**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.6.7**				
Activity Name:	Backfill 216-Z-12				
Activity Description: Backfill includes: • Confirm sample results. • When authorized by DOE-RL and EPA, backfill excavated waste sites.					
Estimated Start Date:	Project Start + 655 weeks				
Duration (workdays):	16				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 16	Backfill and soil cover crew	160	$193,533		
	Fuel charge			$2,304	
	Maintenance Charge			$5,000	
	Revegetate Area (per acre)			$3,362	0.67 acres
	ODCs - (travel, materials, etc.)			$6,126	3% of Activity costs
	General and Administrative			$42,065	20% of subtotal
	contingency			$63,097	AACE class 3, 30%
	Total			**$315,487**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.7**				
Activity Name:	RTD of Soil and Debris from 216-Z-1A, Z-1, Z-2, and Z-3				
Activity Description:	This is a summary of the following activities with identification numbers starting with 1.2.7.				
Estimated Start Date:	Project Start + 655 weeks				
Duration (workdays):	1039				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
	ODCs - (travel, materials, etc.)			$0	3% of Activity costs
	General and Administrative			$0	N/A
	contingency			$0	N/A
	Total			**$0**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**

Activity ID:	**1.2.7.1**				
Activity Name:	Prepare to RTD of 216-Z-1A, Z-1, Z-2, and Z-3				

Activity Description: Prepare to remove contaminated soil and debris includes the following:
• Design excavation.
• Survey and stakeout excavation.
• Stabilize excavation areas with cave-in or subsidence potential.
• Remove structures or debris.
• Clear and grub excavation area.
• Grade field (prepare for work).
• Remove overburden pending use for backfill or dust control.
• Position weather enclosure over the excavation area.
• If required for radiological control (assumed to be areas with TRU contamination levels greater than 5 nCi/g) locate and assemble Contamination Control Structure over the excavation area.
• Verify ventilation system in-place and operating.
• Prepare containers.

Estimated Start Date:	Project Start + 655 weeks				
Duration (workdays):	1023				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 3	Mobilization Crew	512	$695,681		Mobilization crew is used 5% of the time
Crew 5	Overburden Crew	512	$401,867		Overburden crew is used 5% of the time
Crew 6	WE/CCS Setup Crew	1023	$2,242,900		WE/CCS Setup crew is used 10% of the time
	Fuel charge			$7,373	
	Maintenance Charge			$5,000	
	ODCs - (travel, materials, etc.)			$100,585	3% of Activity costs
	General and Administrative			$690,681	20% of subtotal
	contingency			$1,036,022	AACE class 3, 30%
	Total			**$5,180,108**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**	**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**	**CAM: Patrick Baynes**

Activity ID:	**1.2.7.2**				
Activity Name:	Remove 200-W-174-PL				
Activity Description: Remove 200-W-174-PL includes: • Locate and isolate pipeline. • Remove overburden. • Excavate to expose pipeline. • Remove pipeline. • Separate TRU from LLW. • Package for either ERDF or WIPP disposal. • Move packaged waste to staging area. • Sample excavated area per SAP. • Pad in enough fill for contamination control. • When authorized by DOE-RL and EPA, backfill excavated area.					
Estimated Start Date:	Project Start + 655 weeks				
Duration (workdays):	48				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 4	Pipeline Excavation Crew	480	$607,943		
Crew 11	Waste Relocation Crew	480	$616,003		
Crew 15	Sampling Crew	480	$210,878		
	Verification samples (174-PL) - 14 samples			$25,780	
	Greenhouse subsequent use			$302,580	90 cuts in pipeline. Assume 90 moves of greenhouse structure
	SLB2			$15,000	1 SLB2
	Fuel charge			$6,912	
	Maintenance Charge			$5,000	
	ODCs - (travel, materials, etc.)			$53,703	3% of Activity costs
	General and Administrative			$368,760	20% of subtotal
	contingency			$553,139	AACE class 3, 30%
	Total			**$2,765,697**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.7.3**				
Activity Name:	Remove 200-W-210-PL				
Activity Description: Remove 200-W-210-PL includes: • Locate and isolate pipeline. • Remove overburden. • Excavate to expose pipeline. • Remove pipeline. • Separate TRU from LLW. • Package for either ERDF or WIPP disposal. • Move packaged waste to staging area. • Sample excavated area per SAP. • Pad in enough fill for contamination control. • When authorized by DOE-RL and EPA, backfill excavated area.					
Estimated Start Date:	Project Start + 667 weeks				
Duration (workdays):	48				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 4	Pipeline Excavation Crew	480	$607,943		
Crew 11	Waste Relocation Crew	480	$616,003		
Crew 15	Sampling Crew	480	$210,878		
	Verification samples (210-PL) - 14 samples			$25,780	
	Greenhouse subsequent use			$141,204	41 cuts of pipeline + 1 diversion box. Assume 42 moves of the greenhouse structure.
	SLB2			$45,000	3 SLB2s
	Fuel charge			$6,912	
	Maintenance Charge			$5,000	
	ODCs - (travel, materials, etc.)			$49,762	3% of Activity costs
	General and Administrative			$341,696	20% of subtotal
	contingency			$512,544	AACE class 3, 30%
	Total			**$2,562,721**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS: **1.02** **PREPARER: Steve Ferries**

WBS Title: Remove, Treat, and Dispose Contaminated Soil and Debris **CAM: Patrick Baynes**

Activity ID: **1.2.7.4**

Activity Name: RTD of >5 nCi TRU per gram of waste from 216-Z-1A, Z-1, Z-2, and Z-3

Activity Description: Remove, treat, and dispose soil and debris with > 5 nCi/g TRU includes:
- Remove structures or debris.
- Separate TRU from LLW.
- Package debris for either ERDF or WIPP disposal.
- Move packaged waste to staging area.
- Remove soil.
- Separate TRU from LLW.
- Package for either ERDF or WIPP disposal.
- Move packaged waste to staging area.

Estimated Start Date:	Project Start + 679 weeks				
Duration (workdays):	753				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 7	Excavation Crew (>5 nCi TRU per gram of waste)	7530	$8,371,960		
Crew 11	Waste Relocation Crew	7530	$9,663,540		
	WIPP Drums			$806,144	13,002 wipp drums
	9x5x5 container liners			$42,171	843 liners
	Fuel charge			$108,432	
	Maintenance Charge			$40,000	
	ODCs - (travel, materials, etc.)			$570,967	3% of Activity costs
	General and Administrative			$3,920,643	20% of subtotal
	contingency			$5,880,964	AACE class 3, 30%
	Total			**$29,404,822**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.7.5**				
Activity Name:	RTD of <5 nCi TRU per gram of waste from 216-Z-1A, Z-1, Z-2, and Z-3				
Activity Description: Remove, treat, and dispose soil and debris with < 5 nCi/g TRU includes: • Remove structures or debris and prepare for ERDF disposal. • Remove soil and prepare for ERDF disposal. • Move packaged waste to staging area. • Sample excavated waste sites per SAP. • Pad in enough fill for contamination control					
Estimated Start Date:	Project Start + 867 weeks				
Duration (workdays):	174				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 5	Overburden Crew	1740	$1,367,054		
Crew 8	Excavation Crew (<5 nCi TRU per gram of waste)	1740	$1,867,714		
Crew 15	Sampling Crew	1740	$764,434		
	216-Z-1A Cluster (53 samples)			$52,470	
	216-Z-9 (1 deep sample)			$15,000	
	RO container liners			$296,150	5923 liners
	Fuel charge			$25,056	
	Maintenance Charge			$10,000	
	ODCs - (travel, materials, etc.)			$131,936	3% of Activity costs
	General and Administrative			$905,963	20% of subtotal
	contingency			$1,358,944	AACE class 3, 30%
	Total			**$6,794,721**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.7.6**				
Activity Name:	Ship TRU to CWC				
Activity Description: Ship TRU waste to CWC includes: • Confirm that waste is TRU. • Prepare shipping documentation. • Load waste on truck (208 L [55 gallon] drums, SWBs, or SLB2s). • Transport waste to CWC. • This task includes the CWC Receipt Fee and 10 years of CWC storage cost					
Estimated Start Date:	Project Start + 655 weeks				
Duration (workdays):	753				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 12	Process Area Crew	3765	$4,473,306		Crew 12 is used 50% of the time.
Crew 13	Ship to CWC	7530	$6,744,079		
	NDA Daily Lease			$3,529,688	753 days of NDA system lease
	CWC Cost			$22,135,285	2,680 m3
	ODCs - (travel, materials, etc.)			$1,106,471	3% of Activity costs
	General and Administrative			$7,597,766	20% of subtotal
	contingency			$11,396,648	AACE class 3, 30%
	Total			**$56,983,242**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**		**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**		**CAM: Patrick Baynes**

Activity ID:	**1.2.7.7**				
Activity Name:	Dispose of LLW at ERDF (ERDF Disposal Fee)				
Activity Description: Dispose LLW at ERDF includes: • Confirm that waste is LLW. • Prepare shipping documentation. • Load waste on truck (2.7 x 1.5 x 1.r m [9 x 5 x 5 ft] boxes). • Transport waste to ERDF. • This task includes the ERDF disposal fee					
Estimated Start Date:	Project Start + 655 weeks				
Duration (workdays):	1023				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 12	Process Area Crew	5115	$6,077,280		Crew 12 is used 50% of the time.
Crew 14	Ship to ERDF	10230	$10,752,489		
	NDA Daily Lease			$4,795,313	1023 days of NDA system lease
	ERDF Disposal cost per M3			$5,261,576	46,154 m3
	ODCs - (travel, materials, etc.)			$806,600	3% of Activity costs
	General and Administrative			$5,538,651	20% of subtotal
	contingency			$8,307,977	AACE class 3, 30%
	Total			**$41,539,885**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.02**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Contaminated Soil and Debris**				**CAM: Patrick Baynes**
Activity ID:	**1.2.7.8**				
Activity Name:	Backfill 216-Z-1A,Z-1, Z-2, and Z-3				
Activity Description: Backfill includes: • Confirm sample results. • When authorized by DOE-RL and EPA, backfill excavated waste sites.					
Estimated Start Date:	Project Start + 911 weeks				
Duration (workdays):	16				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 16	Backfill and soil cover crew	160	$193,533		
	Fuel charge			$2,304	
	Maintenance Charge			$5,000	
	Revegetate Area (per acre)			$6,709	
	ODCs - (travel, materials, etc.)			$6,226	3% of Activity costs
	General and Administrative			$42,754	20% of subtotal
	contingency			$64,132	AACE class 3, 30%
	Total			**$320,659**	

This page intentionally left blank.

Workbook 3

Remove, Treat, and Dispose Settling Tanks

This page intentionally left blank.

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS: 1.03	PREPARER: Steve Ferries
WBS Title: Remove, Treat, and Dispose Settling Tanks	CAM: Patrick Baynes

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.03**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Settling Tanks**				**CAM: Patrick Baynes**
Activity ID:	**1.3**				
Activity Name:	Remove, Treat, and Dispose of Settling Tanks				
Activity Description:	Remove, Treat, and Dispose the Settling Tanks from the 200-PW-1 and 200-PW-6 Operable Units (includes management and operations of the settling tank remediation system after it is turned over for Operations				
Estimated Start Date:	Project Start + 867 weeks				
Duration (workdays):	400				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
	ODCs - (travel, materials, etc.)			$0	3% of Activity costs
	General and Administrative			$0	N/A
	contingency			$0	N/A
	Total			**$0**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS: 1.03 **PREPARER:** Steve Ferries
WBS Title: Remove, Treat, and Dispose Settling Tanks **CAM:** Patrick Baynes

Activity ID:	**1.3.1**				
Activity Name:	Manage RTD of Settling Tanks				

Activity Description: This activity provides day to day direction for RTD of the settling tanks. It includes the following:
- Manage the settling tank waste sites after turnover of the sites from the current custodian until turnover to the custodian(s) for institutional control of the sites.
- Provide maintenance and ownership of the authorization bases documents (documented safety analyses, air permits, etc.) required for operations and maintenance at the site during the period of management ownership.
- Review and approve project documentation developed during the period of management ownership that affects settling tank work sites (safety bases development and implementation, operating procedures, etc.).
- Manage Operations, Maintenance and Work Control, Engineering, and RadCon.
- Maintain the remediation system.
- Provide engineering support, performance assurance and corrective action coordinator, Environmental Compliance Officer, Material Coordinator, Training, Emergency Preparedness, Industrial safety, nuclear and criticality safety, transportation safety, and QA.
- Write procedures and work packages.

Estimated Start Date:	Project Start + 867 weeks				
Duration (workdays):	400				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 2	Operations Management & Support Crew	4000	$11,884,700		
	ODCs - (travel, materials, etc.)			$356,541	3% of Activity costs
	General and Administrative			$2,448,248	20% of subtotal
	contingency			$4,284,434	AACE class 3, 35%
	Total			**$18,973,924**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.03**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Settling Tanks**				**CAM: Patrick Baynes**
Activity ID:	**1.3.2**				
Activity Name:	RTD of Tank 241-Z-8				
Activity Description: This is a summary of the following activities with identification numbers starting with 1.3.2. Remove, treat, and dispose of Settling Tank 241-Z-8 (relocate weather enclosure, ensure structural integrity of the tank is adequate t proceed, assemble contamination control structure, remove overburden and stockpile pending use for backfill or dust control, uncover tank, isolate tank, characterize tank and sludge, grout sludge inside of the tank, cut tank, and prepare for disposal at WIPP)					
Estimated Start Date:	Project Start + 867 weeks				
Duration (workdays):	112				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
	ODCs - (travel, materials, etc.)			$0	3% of Activity costs
	General and Administrative			$0	N/A
	contingency			$0	N/A
	Total			**$0**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.03**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Settling Tanks**				**CAM: Patrick Baynes**
Activity ID:	**1.3.2.1**				
Activity Name:	Prepare to RTD of 241-Z-8				

Activity Description: The activities to prepare 241-Z-8 for RTD include:
- Design the excavation.
- Perform supplemental surveying, clearing, grubbing, and grading required for the operation.
- Remove overburden and stockpile pending use for backfill or dust control.
- Place weather enclosure over the excavation area.
- Excavate sufficiently to expose entire tank and provide working area for RTD of tank.
- Disposition soil based on assay.
- Install contamination control structure.
- Move equipment and supplies to appropriate work locations within and around contamination control structure and weather enclosure for RTD of tank.

Estimated Start Date:	Project Start + 867 weeks				
Duration (workdays):	24				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 3	Mobilization Crew	24	$32,642		Mobilization crew is used 10% of the time
Crew 5	Overburden Crew	24	$18,856		Overburden crew is used 10% of the time
Crew 6	WE/CCS Setup Crew	240	$526,194		WE/CCS Setup crew is used 100% of the time
	Fuel charge			$346	
	Maintenance Charge			$5,000	
	ODCs - (travel, materials, etc.)			$17,491	3% of Activity costs
	General and Administrative			$120,106	20% of subtotal
	contingency			$210,185	AACE class 3, 35%
	Total			**$930,819**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.03**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Settling Tanks**				**CAM: Patrick Baynes**
Activity ID:	**1.3.2.2**				
Activity Name:	Add Fixative to 241-Z-8				
Activity Description: Adding fixative to 241-Z-8 involves partially filling the tank with grout (or alternative fixative) to immobilize contamination.					
Estimated Start Date:	Project Start + 873 weeks				
Duration (workdays):	24				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 9	241-Z-8 Settling Tank Crew	240	$287,637		
	Fixative Invisible Blue (5 gallon pail)			$890	cost of fixative
	ODCs - (travel, materials, etc.)			$8,656	3% of Activity costs
	General and Administrative			$59,437	20% of subtotal
	contingency			$104,014	AACE class 3, 35%
	Total			**$460,634**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.03**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Settling Tanks**				**CAM: Patrick Baynes**
Activity ID:	**1.3.2.3**				
Activity Name:	Size Reduce and Remove 241-Z-8				
Activity Description: Size reduction and removal of Tank 241-Z-8 includes: • Externally assay tank to determine section sizes that can be disposed within a SLB2 container. • Section tank and crush sections sufficiently to place into the SLB2. • Package waste for either ERDF or WIPP disposal. • Move packaged waste to staging area. • Sample excavation area per approved SAP. • Pad in enough fill for contamination control.					
Estimated Start Date:	Project Start + 879 weeks				
Duration (workdays):	48				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 9	241-Z-8 Settling Tank Crew	480	$575,275		
Crew 11	Waste Relocation Crew	480	$616,003		
Crew 15	Sampling Crew	480	$210,878		
	Fuel charge			$6,912	
	Maintenance Charge			$5,000	
	241-Z-8 (14 samples)			$13,860	
	241-Z-8 (1 deep sample)			$15,000	
	RO container liners			$1,230	25 liners
	ODCs - (travel, materials, etc.)			$43,325	3% of Activity costs
	General and Administrative			$297,496	20% of subtotal
	contingency			$520,619	AACE class 3, 35%
	Total			**$2,305,597**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS: 1.03
WBS Title: Remove, Treat, and Dispose Settling Tanks

PREPARER: Steve Ferries
CAM: Patrick Baynes

Activity ID:	**1.3.2.4**				
Activity Name:	Ship TRU to CWC				
Activity Description: Ship TRU waste to CWC includes: • Confirm that waste is TRU. • Prepare shipping documentation. • Load waste on truck (208 L [55 gallon] drums, SWBs, or SLB2s). • Transport waste to CWC. • This task includes the CWC Receipt Fee and 10 years of CWC storage cost					
Estimated Start Date:	Project Start + 867 weeks				
Duration (workdays):	48				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 12	Process Area Crew	240	$285,151		Crew 12 is used 50% of the time
Crew 13	Ship to CWC	480	$429,901		
	SLB2			$508,480	34 SLB2s
	NDA Daily Lease			$225,000	48 days of NDA system lease
	CWC Cost			$533,696	65 M3 of TRU waste
	ODCs - (travel, materials, etc.)			$59,467	3% of Activity costs
	General and Administrative			$408,339	20% of subtotal
	contingency			$714,593	AACE class 3, 35%
	Total			**$3,164,627**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.03**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Settling Tanks**				**CAM: Patrick Baynes**
Activity ID:	**1.3.2.5**				
Activity Name:	Dispose of LLW at ERDF (ERDF Disposal Fee)				
Activity Description: Dispose LLW at ERDF includes: • Confirm that waste is LLW. • Prepare shipping documentation. • Load waste on truck (2.7 x 1.5 x 1.5 m [9 x 5 x 5 ft] boxes). • Transport waste to ERDF. • This task includes the ERDF disposal fee.					
Estimated Start Date:	Project Start + 867 weeks				
Duration (workdays):	48				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 12	Process Area Crew	240	$285,151		Crew 12 is use 50% of the time.
Crew 14	Ship to ERDF	480	$504,516		
	NDA Daily Lease			$225,000	48 days of NDA system lease
	ERDF Disposal cost per M3			$19,627	172 m3 of waste sent to ERDF
	ODCs - (travel, materials, etc.)			$31,029	3% of Activity costs
	General and Administrative			$213,064	20% of subtotal
	contingency			$372,863	AACE class 3, 35%
	Total			**$1,651,250**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.03**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Settling Tanks**				**CAM: Patrick Baynes**
Activity ID:	**1.3.2.6**				
Activity Name:	Backfill and revegetate 214-Z-8				
Activity Description: This activity includes: • Confirm sample results. • Demobilize settling tanks remediation system at 241-Z-8. • When authorized by DOE-RL and EPA, backfill excavation area. • Revegetate 241-Z-8 excavation area					
Estimated Start Date:	Project Start + 891 weeks				
Duration (workdays):	16				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 16	Backfill and soil cover crew	160	$193,533		Pad in enough fill for contamination control
	Revegetate Area (per acre`			$501	Assume minimum of 0.1 acres
	Fuel charge			$2,304	Fuel charge based on 540 hours of operation
	Maintenance Charge			$5,000	
	ODCs - (travel, materials, etc.)			$6,040	3% of Activity costs
	General and Administrative			$41,476	20% of subtotal
	contingency			$72,582	AACE class 3, 35%
	Total			**$321,436**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.03**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Settling Tanks**				**CAM: Patrick Baynes**
Activity ID:	**1.3.3**				
Activity Name:	RTD of Tank 241-Z-361				
Activity Description: This is a summary of the following activities with identification numbers starting with 1.3.3. Remove, treat, and dispose of Settling Tank 241-Z-316 (relocate weather enclosure, ensure structural integrity of the tank is adequat to proceed; assemble contamination control structure, remove overburden and stockpile pending use for backfill or dust control, uncover tank, isolate tank, characterize tank and sludge, remove sludge to facilitate tank removal, apply fixative to tank after sludge removal, cut tank, package and prepare for disposal at WIPP)					
Estimated Start Date:	Project Start + 867 weeks				
Duration (workdays):	380				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
	ODCs - (travel, materials, etc.)			$0	3% of Activity costs
	General and Administrative			$0	N/A
	contingency			$0	N/A
	Total			**$0**	

WBS:	**1.03**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Settling Tanks**				**CAM: Patrick Baynes**
Activity ID:	**1.3.3.1**				
Activity Name:	Prepare to RTD of 241-Z-361				

Activity Description: The activities to prepare 241-Z-361 for RTD include:
- Design the excavation.
- Perform supplemental surveying, clearing, grubbing, and grading required for the operation.
- Remove overburden and stockpile pending use for backfill or dust control.
- Place weather enclosure over the excavation area.
- Excavate sufficiently to expose entire tank and provide working area for RTD of tank.
- Disposition soil based on assay.
- Install contamination control structure.
- Install the 241-Z-361 process enclosure on exposed face of tank.
- Install grouting and drying equipment and container loading system.
- Install ventilation system on tank and provide ventilation opening to provide ventilation exhaust from process enclosure through tank to exhaust skid.
- Install sludge removal equipment in tank.
- Provide penetration into tank as necessary to facilitate grout removal.
- Move equipment and supplies to appropriate work locations within and around contamination control structure and weather enclosure for RTD of tank.

Estimated Start Date:	Project Start + 867 weeks				
Duration (workdays):	108				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 3	Mobilization Crew	108	$146,889		Mobilization crew is used 10% of the time
Crew 5	Overburden Crew	108	$84,852		Overburden crew is used 10% of the time
Crew 6	WE/CCS Setup Crew	1080	$2,367,871		WE/CCS Setup crew is used 100% of the time
	Fuel charge			$1,555	
	Maintenance Charge			$5,000	
	ODCs - (travel, materials, etc.)			$78,035	3% of Activity costs
	General and Administrative			$536,840	20% of subtotal
	contingency			$939,471	AACE class 3, 35%
	Total			**$4,160,512**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.03**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Settling Tanks**				**CAM: Patrick Baynes**
Activity ID:	**1.3.3.2**				
Activity Name:	Remove Sludge from 241-Z-361				
Activity Description: This activity includes: • Transfer sludge from the tank into the process enclosure using sludge removal equipment. • Grout sludge, dry, assay, size reduce and load into 208 L (55 gallon) drums for later disposal at WIPP					
Estimated Start Date:	Project Start + 894 weeks				
Duration (workdays):	108				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 10	241-Z-361 Settling Tank Crew	1080	$1,457,864		
Crew 11	Waste Relocation Crew	1080	$1,386,006		
	ODCs - (travel, materials, etc.)			$85,316	3% of Activity costs
	General and Administrative			$585,837	20% of subtotal
	contingency			$1,025,215	AACE class 3, 35%
	Total			**$4,540,238**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS: 1.03
WBS Title: Remove, Treat, and Dispose Settling Tanks

PREPARER: Steve Ferries
CAM: Patrick Baynes

Activity ID:	**1.3.3.3**				
Activity Name:	Add Fixative to 241-Z-361				
Activity Description: After removal of sufficient sludge from the tank to support packaging and treatment of the tank for WIPP acceptance, grout bottom foot of the tank and apply fixative to the exposed inside walls of the tanks for contamination control.					
Estimated Start Date:	Project Start + 921 weeks				
Duration (workdays):	24				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 10	241-Z-361 Settling Tank Crew	240	$323,970		
	Fixative Invisible Blue (5 gallon pail)			$1,780	Fixative for sealing and stabilizing remaining waste on sides of settling tank and outside of tank structure
	ODCs - (travel, materials, etc.)			$9,772	3% of Activity costs
	General and Administrative			$67,104	20% of subtotal
	contingency			$117,433	AACE class 3, 35%
	Total			**$520,060**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS: **1.03**
WBS Title: **Remove, Treat, and Dispose Settling Tanks**

PREPARER: **Steve Ferries**
CAM: **Patrick Baynes**

Activity ID:	**1.3.3.4**				
Activity Name:	Size Reduce and Remove 241-Z-361				
Activity Description: Activity Description: Size reduction and removal of Tank 241-Z-361 includes: • Section tank and crush sections sufficiently to place into the SLB2. • Package waste for either ERDF or WIPP disposal. • Move packaged waste to staging area. • Sample excavation area per approved SAP. • Pad in enough fill for contamination control.					
Estimated Start Date:	Project Start + 927 weeks				
Duration (workdays):	108				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 10	241-Z-361 Settling Tank Crew	1080	$1,457,864		
Crew 11	Waste Relocation Crew	1080	$1,386,006		
Crew 15	Sampling Crew	1080	$474,476		
	SLB2			$601,042	Purchase 40 SLB2s
	RO container liners			$97,173	Purchase 1,943 roll-on liners
	241-Z-361 (14 sample)			$13,860	
	241-Z-361 (1 deep sample)			$15,000	
	ODCs - (travel, materials, etc.)			$121,363	3% of Activity costs
	General and Administrative			$833,357	20% of subtotal
	contingency			$1,458,374	AACE class 3, 35%
	Total			**$6,458,515**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.03**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Settling Tanks**				**CAM: Patrick Baynes**
Activity ID:	**1.3.3.5**				
Activity Name:	Ship TRU to CWC				
Activity Description: Ship TRU waste to CWC includes: • Confirm that waste is TRU. • Prepare shipping documentation. • Load waste on truck (207 L [55 gallon] drums, SWBs, or SLB2s). • Transport waste to CWC. • This task includes the CWC Receipt Fee and 10 years of CWC storage cost					
Estimated Start Date:	Project Start + 927 weeks				
Duration (workdays):	108				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 12	Process Area Crew	540	$641,590		Crew 12 is used 50% of the time.
Crew 13	Ship to CWC	1080	$967,278		
	NDA Daily Lease			$506,250	108 days of NDA system lease
	WIPP Drums			$73,437	1,184 containers
	CWC Cost			$3,162,865	383 m3
	ODCs - (travel, materials, etc.)			$160,543	3% of Activity costs
	General and Administrative			$1,102,393	20% of subtotal
	contingency			$1,929,187	AACE class 3, 35%
	Total			**$8,543,542**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.03**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Settling Tanks**				**CAM: Patrick Baynes**
Activity ID:	**1.3.3.6**				
Activity Name:	Dispose of LLW at ERDF (ERDF Disposal Fee)				
Activity Description: Dispose LLW at ERDF includes: • Confirm that waste is LLW. • Prepare shipping documentation. • Load waste on truck (2.7 L x 1.5 x 1.5 m [9 x 5 x 5 ft] boxes). • Transport waste to ERDF. • This task includes the ERDF disposal fee.					
Estimated Start Date:	Project Start + 894 weeks				
Duration (workdays):	240				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 12	Process Area Crew	240	$285,151		Crew 12 is used 10% of the time.
Crew 14	Ship to ERDF	240	$252,258		Crew 14 is used 10% of the time.
	NDA Daily Lease			$1,125,000	240 days of NDA system lease
	ERDF Disposal cost per M3			$1,550,887	13,604 m3 sent to ERDF
	ODCs - (travel, materials, etc.)			$96,399	3% of Activity costs
	General and Administrative			$661,939	20% of subtotal
	contingency			$1,158,393	AACE class 3, 35%
	Total			**$5,130,027**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.03**				**PREPARER: Steve Ferries**
WBS Title:	**Remove, Treat, and Dispose Settling Tanks**				**CAM: Patrick Baynes**
Activity ID:	**1.3.3.7**				
Activity Name:	Backfill and revegetate 214-Z-361				
Activity Description: Dispose LLW at ERDF includes: • Confirm that waste is LLW. • Prepare shipping documentation. • Load waste on truck (2.7 L x 1.5 x 1.5 m [9 x 5 x 5 ft] boxes). • Transport waste to ERDF. • This task includes the ERDF disposal fee.					
Estimated Start Date:	Project Start + 954 weeks				
Duration (workdays):	32				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 16	Backfill and soil cover crew	320	$387,066		
	Revegetate Area (per acre)			$501	Assume a minimum of 0.1 Acre
	Fuel charge			$4,608	Based on 16 days of service
	Maintenance Charge			$5,000	
	ODCs - (travel, materials, etc.)			$11,915	3% of Activity costs
	General and Administrative			$81,818	20% of subtotal
	contingency			$143,181	AACE class 3, 35%
	Total			**$634,089**	

Workbook 4

Enhance Soil Cover, Install ET Barriers, and Demobilize Project

This page intentionally left blank.

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS: 1.04	**PREPARER: Steve Ferries**
WBS Title: Enhance Soil Cover, Install ET Barriers, and Demobilize	**CAM: Patrick Baynes**

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.04**				**PREPARER: Steve Ferries**
WBS Title:	**Enhance Soil Cover, Install ET Barriers, and Demobilize**				**CAM: Patrick Baynes**
Activity ID:	**1.4**				
Activity Name:	Enhance Soil Cover, Install ET Barriers, and Demobilize the Project				
Activity Description: Enhance Soil Cover, Install ET Barriers, and Demobilize the Project includes enhancing the soil cover over the 200-PW-3 waste sites, installing ET Barriers over the 200-PW-1 and 200-PW-6 waste sites, and demobilizing the remediation project (e.g. installing replacement wells and dispositioning the remediation system).					
Estimated Start Date:	Project Start + 894 weeks				
Duration (workdays):	376				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
	ODCs - (travel, materials, etc.)			$0	3% of Activity costs
	General and Administrative			$0	N/A
	contingency			$0	N/A
	Total			**$0**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS: 1.04 | **PREPARER: Steve Ferries**

WBS Title: Enhance Soil Cover, Install ET Barriers, and Demobilize | **CAM: Patrick Baynes**

Activity ID:	**1.4.1**				
Activity Name:	Manage Enhance Soil Cover, Install ET Barriers, and Demobilize the Project				
Activity Description: This activity provides day to day direction for enhancing the soil cover and installing ET barriers. It includes the following: • Manage the waste sites after turnover of the sites from the RTD custodian until turnover to the custodian(s) for institutional control of the sites. • Complete barrier designs. • Acquire soil cover and barrier material.					
Estimated Start Date:	Project Start + 894 weeks				
Duration (workdays):	358				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 2	Operations Management & Support Crew	3580	$10,636,807		
	ODCs - (travel, materials, etc.)			$319,104	3% of Activity costs
	General and Administrative			$2,191,182	20% of subtotal
	contingency			$1,643,387	AACE class 3, 15%
	Total			**$14,790,479**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.04**				**PREPARER: Steve Ferries**
WBS Title:	**Enhance Soil Cover, Install ET Barriers, and Demobilize**				**CAM: Patrick Baynes**
Activity ID:	**1.4.2**				
Activity Name:	Enhance Soil Cover for Cs-137 Waste Sites				
Activity Description:	This activity adds soil cover, as necessary, for the Cs-137 waste sites				
Estimated Start Date:	Project Start + 894 weeks				
Duration (workdays):	36				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 16	Backfill and soil cover crew	360	$435,449		
	ODCs - (travel, materials, etc.)			$13,063	3% of Activity costs
	General and Administrative			$89,702	20% of subtotal
	contingency			$67,277	AACE class 3, 15%
	Total			**$605,492**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.04**				**PREPARER: Steve Ferries**
WBS Title:	**Enhance Soil Cover, Install ET Barriers, and Demobilize**				**CAM: Patrick Baynes**
Activity ID:	**1.4.3**				
Activity Name:	Install ET Barriers				
Activity Description:	This is a summary of the following activities with identification numbers starting with 1.4.3.				
Estimated Start Date:	Project Start + 894 weeks				
Duration (workdays):	216				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
	ODCs - (travel, materials, etc.)			$0	3% of Activity costs
	General and Administrative			$0	N/A
	contingency			$0	N/A
	Total			**$0**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS: 1.04		**PREPARER: Steve Ferries**
WBS Title: Enhance Soil Cover, Install ET Barriers, and Demobilize		**CAM: Patrick Baynes**

Activity ID:	**1.4.3.1**				
Activity Name:	Install ET Barrier for 216-Z-5				
Activity Description:	This activity installs the ET Barrier for 216-Z-5 to cover the waste site footprint.				
Estimated Start Date:	Project Start + 894 weeks				
Duration (workdays):	36				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 17	Barrier Crew	360	$235,060		Haul/grade/spread/compact/ grade
	Layer 3 - Engineered Fill (material cost)			$0	Assume material from onsite.
	Layer 2 - Silt loam (material cost)			$11,235	Raw material cost.
	Layer 1 - Pea gravel (material cost)			$4,920	Assume 2/3 of Layer 1. Raw material cost.
	Layer 1 - Silt (material cost)			$2,949	Assume 1/3 of Layer 1. Raw material cost.
	Filter gravel (material cost)			$2,014	Raw material cost (pea gravel).
	Ballast rock (material cost)			$3,611	Raw material cost.
	Basalt (material cost)			$5,032	Assume 2/3 of layer. Raw material cost.
	Soil (material cost)			$1,734	Assume 1/3 of layer. Raw material cost.
	Refueling of equipment			$5,184	Fuel cost
	Maintenance Charge			$5,000	
	ODCs - (travel, materials, etc.)			$8,302	3% of Activity costs
	General and Administrative			$57,008	20% of subtotal
	contingency			$42,756	AACE class 3, 15%
	Total			**$384,804**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.04**				**PREPARER: Steve Ferries**
WBS Title:	**Enhance Soil Cover, Install ET Barriers, and Demobilize**				**CAM: Patrick Baynes**
Activity ID:	**1.4.3.2**				
Activity Name:	Install ET Barrier for 216-Z-18				
Activity Description:	This activity installs the ET Barrier for 216-Z-18 to cover the waste site footprint.				
Estimated Start Date:	Project Start + 903 weeks				
Duration (workdays):	54				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 17	Barrier Crew	540	$352,590		Haul/grade/spread/compact/grade
	Layer 3 - Engineered Fill (material cost)			$0	Assume material from onsite.
	Layer 2 - Silt loam (material cost)			$148,940	Raw material cost.
	Layer 1 - Pea gravel (material cost)			$78,075	Assume 2/3 of Layer 1. Raw material cost.
	Layer 1 - Silt (material cost)			$46,792	Assume 1/3 of Layer 1. Raw material cost.
	Filter gravel (material cost)			$6,881	Raw material cost (pea gravel).
	Ballast rock (material cost)			$12,075	Raw material cost.
	Basalt (material cost)			$16,318	Assume 2/3 of layer. Raw material cost.
	Soil (material cost)			$5,623	Assume 1/3 of layer. Raw material cost.
	Refueling of equipment			$7,776	Fuel cost
	Maintenance Charge			$5,000	
	ODCs - (travel, materials, etc.)			$20,402	3% of Activity costs
	General and Administrative			$140,094	20% of subtotal
	contingency			$105,071	AACE class 3, 15%
	Total			**$945,638**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS: 1.04 **PREPARER: Steve Ferries**

WBS Title: Enhance Soil Cover, Install ET Barriers, and Demobilize **CAM: Patrick Baynes**

Activity ID:	**1.4.3.3**				
Activity Name:	Install ET Barrier for 216-Z-12				
Activity Description:	This activity installs the ET Barrier for 216-Z-12 to cover the waste site footprint.				
Estimated Start Date:	Project Start + 917 weeks				
Duration (workdays):	36				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 17	Barrier Crew	360	$235,060		Haul/grade/spread/compact/grade
	Layer 3 - Engineered Fill (material cost)			$0	Assume material from onsite.
	Layer 2 - Silt loam (material cost)			$49,072	Raw material cost.
	Layer 1 - Pea gravel (material cost)			$22,685	Assume 2/3 of Layer 1. Raw material cost.
	Layer 1 - Silt (material cost)			$13,596	Assume 1/3 of Layer 1. Raw material cost.
	Filter gravel (material cost)			$4,835	Raw material cost (pea gravel).
	Ballast rock (material cost)			$8,518	Raw material cost.
	Basalt (material cost)			$11,575	Assume 2/3 of layer. Raw material cost.
	Soil (material cost)			$3,989	Assume 1/3 of layer. Raw material cost.
	Refueling of equipment			$5,184	Fuel cost
	Maintenance Charge			$5,000	
	ODCs - (travel, materials, etc.)			$10,785	3% of Activity costs
	General and Administrative			$74,060	20% of subtotal
	contingency			$55,545	AACE class 3, 15%
	Total			**$499,903**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.04**				**PREPARER: Steve Ferries**
WBS Title:	**Enhance Soil Cover, Install ET Barriers, and Demobilize**				**CAM: Patrick Baynes**
Activity ID:	**1.4.3.4**				
Activity Name:	Install ET Barrier for 216-Z-9				
Activity Description:	This activity installs the ET Barrier for 216-Z-9 to cover the waste site footprint.				
Estimated Start Date:	Project Start + 926 weeks				
Duration (workdays):	36				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 17	Barrier Crew	360	$235,060		Haul/grade/spread/compact/grade
	Layer 3 - Engineered Fill (material cost)			$0	Assume material from onsite.
	Layer 2 - Silt loam (material cost)			$18,783	Raw material cost.
	Layer 1 - Pea gravel (material cost)			$8,793	Assume 2/3 of Layer 1. Raw material cost.
	Layer 1 - Silt (material cost)			$5,270	Assume 1/3 of Layer 1. Raw material cost.
	Filter gravel (material cost)			$2,474	Raw material cost (pea gravel).
	Ballast rock (material cost)			$4,411	Raw material cost.
	Basalt (material cost)			$6,098	Assume 2/3 of layer. Raw material cost.
	Soil (material cost)			$2,102	Assume 1/3 of layer. Raw material cost.
	Refueling of equipment			$5,184	Fuel cost
	Maintenance Charge			$5,000	
	ODCs - (travel, materials, etc.)			$8,795	3% of Activity costs
	General and Administrative			$60,394	20% of subtotal
	contingency			$45,295	AACE class 3, 15%
	Total			**$407,659**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.04**				**PREPARER: Steve Ferries**
WBS Title:	**Enhance Soil Cover, Install ET Barriers, and Demobilize**				**CAM: Patrick Baynes**
Activity ID:	**1.4.3.5**				
Activity Name:	Install ET Barrier for 216-Z-1A, Z-1, Z-2, and Z-3				
Activity Description:	This activity installs the ET Barrier for 216-Z-1A, Z-1, Z-2, and Z-3 to cover the waste site footprint.				
Estimated Start Date:	Project Start + 935 weeks				
Duration (workdays):	54				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 17	Barrier Crew	540	$352,590	$0	Haul/grade/spread/compact/grade
	Layer 3 - Engineered Fill (material cost)			$0	Assume material from onsite.
	Layer 2 - Silt loam (material cost)			$136,582	Raw material cost.
	Layer 1 - Pea gravel (material cost)			$71,245	Assume 2/3 of Layer 1. Raw material cost.
	Layer 1 - Silt (material cost)			$42,699	Assume 1/3 of Layer 1. Raw material cost.
	Filter gravel (material cost)			$6,820	Raw material cost (pea gravel).
	Ballast rock (material cost)			$11,969	Raw material cost.
	Basalt (material cost)			$16,176	Assume 2/3 of layer. Raw material cost.
	Soil (material cost)			$5,575	Assume 1/3 of layer. Raw material cost.
	Refueling of equipment			$7,776	Fuel cost
	Maintenance Charge			$5,000	
	ODCs - (travel, materials, etc.)			$19,693	3% of Activity costs
	General and Administrative			$135,225	20% of subtotal
	contingency			$101,419	AACE class 3, 15%
	Total			**$912,768**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.04**				**PREPARER: Steve Ferries**
WBS Title:	**Enhance Soil Cover, Install ET Barriers, and Demobilize**				**CAM: Patrick Baynes**
Activity ID:	**1.4.4**				
Activity Name:	Demobilize the Project				
Activity Description: remediation system(s).	Project demobilization includes installation of replacement wells and disposition of the				
Estimated Start Date:	Project Start + 962 weeks				
Duration (workdays):	104				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 18	Demobilization Crew	1040	$2,194,090		
subcontract	subcontract	792	$74,020		
subcontract	S/C drilling and waste dispo			$4,452,829	Replacing wells taken out earlier in the project
	ODCs - (travel, materials, etc.)			$201,628	3% of Activity costs
	General and Administrative			$1,384,513	20% of subtotal
	contingency			$1,038,385	AACE class 3, 15%
	Total			**$9,345,465**	

This page intentionally left blank.

Workbook 5

Long-Term Stewardship

This page intentionally left blank.

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS: 1.05	**PREPARER: Steve Ferries**
WBS Title: Long-Term Stewardship	**CAM: Patrick Baynes**

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.05**				**PREPARER: Steve Ferries**
WBS Title:	**Long-Term Stewardship**				**CAM: Patrick Baynes**
Activity ID:	**1.5**				
Activity Name:	Long-Term Stewardship				
Activity Description: Institutional Controls for the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units includes controlling site access; surveillance, operations, and maintenance; and the CERCLA Five-Year Reviews.					
Estimated Start Date:	Project Start + 988 weeks				
Duration (workdays):	0				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
	ODCs - (travel, materials, etc.)			$0	3% of Activity costs
	General and Administrative			$0	N/A
	contingency			$0	N/A
	Total			**$0**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.05**				**PREPARER: Steve Ferries**
WBS Title:	**Long-Term Stewardship**				**CAM: Patrick Baynes**
Activity ID:	**1.5.1**				
Activity Name:	Manage Long-Term Stewardship				
Activity Description: This activity provides day-to-day direction for maintaining institutional controls. It includes managing manage the waste sites after turnover of the sites from the RTD custodian.					
Estimated Start Date:	Project Start + 988 weeks				
Duration (workdays):	0				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
	ODCs - (travel, materials, etc.)			$0	3% of Activity costs
	General and Administrative			$0	N/A
	contingency			$0	N/A
	Total			**$0**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.05**				**PREPARER: Steve Ferries**
WBS Title:	**Long-Term Stewardship**				**CAM: Patrick Baynes**
Activity ID:	**1.5.2**				
Activity Name:	Institutional Controls				
Activity Description: This activity complies with the requirement to control access to the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units after completion of the remedial actions.					
Estimated Start Date:	Project Start + 988 weeks				
Duration (workdays):	0				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
	Institutional Controls - Programmatic		$24,700,000		This is the institutional controls cost from the engineering calculation file (Mission Support Alliance) for 1,000 years
	ODCs - (travel, materials, etc.)			$741,000	3% of Activity costs
	General and Administrative			$5,088,200	20% of subtotal
	contingency			$0	N/A
	Total			**$30,529,200**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS: 1.05	**PREPARER: Steve Ferries**
WBS Title: Long-Term Stewardship	**CAM: Patrick Baynes**

Activity ID:	**1.5.3**				
Activity Name:	Surveillance, Operations, and Maintenance				
Activity Description: Surveillance, operations, and maintenance includes groundwater monitoring, barrier maintenance, enhanced soil cover maintenance, and soil vapor extraction (SVE) operations (during soil vapor extraction operations, vapor-phase carbon tetrachloride is extracted through vadose zone wells and adsorbed onto granular activated carbon before the treated, clean vapor is released to the atmosphere).					
Estimated Start Date:	Project Start + 988 weeks				
Duration (workdays):	0				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
Crew 17	Barrier Crew	360	$470,120		Assume replace every 500 yrs cost for ET Barrier 216-Z-5)
	Silt, silt loam			$22,470	Assume replace every 500 yrs cost for ET Barrier 216-Z-5)
	Gravel, pea gravel			$9,840	Assume replace every 500 yrs cost for ET Barrier 216-Z-5)
	Silt, silt loam			$5,897	Assume replace every 500 yrs cost for ET Barrier 216-Z-5)
	Gravel, pea gravel			$4,027	Assume replace every 500 yrs cost for ET Barrier 216-Z-5)
	Ballast			$7,222	Assume replace every 500 yrs cost for ET Barrier 216-Z-5)
	Ballast			$10,064	Assume replace every 500 yrs cost for ET Barrier 216-Z-5)
	Silt, silt loam			$3,468	Assume replace every 500 yrs cost for ET Barrier 216-Z-5)
	Fuel charge			$10,368	Assume replace every 500 yrs cost for ET Barrier 216-Z-5)
Crew 17	Barrier Crew	540	$705,180		Assume replace every 500 yrs cost for ET Barrier 216-Z-18)
	Silt, silt loam			$297,881	Assume replace every 500 yrs cost for ET Barrier 216-Z-18)
	Gravel, pea gravel			$156,150	Assume replace every 500 yrs cost for ET Barrier 216-Z-18)

WBS: 1.05 WBS Title: Long-Term Stewardship					PREPARER: Steve Ferries CAM: Patrick Baynes
	Silt, silt loam			$93,585	Assume replace every 500 yrs cost for ET Barrier 216-Z-18)
	Gravel, pea gravel			$13,761	Assume replace every 500 yrs cost for ET Barrier 216-Z-18)
	Ballast			$24,150	Assume replace every 500 yrs cost for ET Barrier 216-Z-18)
	Ballast			$32,635	Assume replace every 500 yrs cost for ET Barrier 216-Z-18)
	Silt, silt loam			$11,246	Assume replace every 500 yrs cost for ET Barrier 216-Z-18)
	Fuel charge			$15,552	Assume replace every 500 yrs cost for ET Barrier 216-Z-18)
Crew 17	Barrier Crew	360	$470,120		Assume replace every 500 yrs cost for ET Barrier 216-Z-12)
	Silt, silt loam			$98,145	Assume replace every 500 yrs cost for ET Barrier 216-Z-12)
	Gravel, pea gravel			$45,370	Assume replace every 500 yrs cost for ET Barrier 216-Z-12)
	Silt, silt loam			$27,191	Assume replace every 500 yrs cost for ET Barrier 216-Z-12)
	Gravel, pea gravel			$9,670	Assume replace every 500 yrs cost for ET Barrier 216-Z-12)
	Ballast			$17,036	Assume replace every 500 yrs cost for ET Barrier 216-Z-12)
	Ballast			$23,149	Assume replace every 500 yrs cost for ET Barrier 216-Z-12)

WBS: 1.05 WBS Title: Long-Term Stewardship					PREPARER: Steve Ferries CAM: Patrick Baynes
	Silt, silt loam			$7,977	Assume replace every 500 yrs cost for ET Barrier 216-Z-12)
	Fuel charge			$10,368	Assume replace every 500 yrs cost for ET Barrier 216-Z-12)
Crew 17	Barrier Crew	360	$470,120		Assume replace every 500 yrs cost for ET Barrier 216-Z-9)
	Silt, silt loam			$37,566	Assume replace every 500 yrs cost for ET Barrier 216-Z-9)
	Gravel, pea gravel			$17,587	Assume replace every 500 yrs cost for ET Barrier 216-Z-9)
	Silt, silt loam			$10,540	Assume replace every 500 yrs cost for ET Barrier 216-Z-9)
	Gravel, pea gravel			$4,947	Assume replace every 500 yrs cost for ET Barrier 216-Z-9)
	Ballast			$8,821	Assume replace every 500 yrs cost for ET Barrier 216-Z-9)
	Ballast			$12,197	Assume replace every 500 yrs cost for ET Barrier 216-Z-9)
	Silt, silt loam			$4,203	Assume replace every 500 yrs cost for ET Barrier 216-Z-9)
	Fuel charge			$10,368	Assume replace every 500 yrs cost for ET Barrier 216-Z-9)
Crew 17	Barrier Crew	540	$705,180		Assume replace every 500 years for ET Barrier for 216-Z-1A, Z-1, Z-2, and Z-3)
	Silt, silt loam			$273,165	Assume replace every 500 years for ET Barrier for 216-Z-1A, Z-1, Z-2, and Z-3)
	Gravel, pea gravel			$142,490	Assume replace every 500 years for ET Barrier for 216-Z-1A, Z-1, Z-2, and Z-3)

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS: 1.05 WBS Title: Long-Term Stewardship					PREPARER: Steve Ferries CAM: Patrick Baynes
	Silt, silt loam			$85,398	Assume replace every 500 years for ET Barrier for 216-Z-1A, Z-1, Z-2, and Z-3)
	Gravel, pea gravel			$13,639	Assume replace every 500 years for ET Barrier for 216-Z-1A, Z-1, Z-2, and Z-3)
	Ballast			$23,938	Assume replace every 500 years for ET Barrier for 216-Z-1A, Z-1, Z-2, and Z-3)
	Ballast			$32,352	Assume replace every 500 years for ET Barrier for 216-Z-1A, Z-1, Z-2, and Z-3)
	Silt, silt loam			$11,149	Assume replace every 500 years for ET Barrier for 216-Z-1A, Z-1, Z-2, and Z-3)
	Fuel charge			$15,552	Assume replace every 500 years for ET Barrier for 216-Z-1A, Z-1, Z-2, and Z-3)
	ODCs - (travel, materials, etc.)			$134,456	3% of Activity costs
	General and Administrative			$923,262	20% of subtotal
	contingency			$692,446	AACE class 3, 15%
	Total			**$6,232,017**	

200-CW-5 and 200-PW-1/3/6 Remediation Basis of Estimate

WBS:	**1.05**				**PREPARER: Steve Ferries**
WBS Title:	**Long-Term Stewardship**				**CAM: Patrick Baynes**
Activity ID:	**1.5.4**				
Activity Name:	CERCLA 5-Year Review				
Activity Description: This activity complies with the requirement to complete the CERCLA five-year review of the 200-CW-5, 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units.					
Estimated Start Date:	Project Start + 988 weeks				
Duration (workdays):	0				
Earned Value Method:	% Complete				
Resource ID	**Resource Description**	**Hours**	**Labor $$**	**Nonlabor $$**	**Comment**
	5 year reviews		$4,164,000		Cost for 1,000 years of five-year reviews (200 reviews)
	ODCs - (travel, materials, etc.)			$124,920	3% of Activity costs
	General and Administrative			$857,784	20% of subtotal
	contingency			$0	N/A
	Total			**$5,146,704**	

This page intentionally left blank.

Workbook 6

Work Crews and Costs

This page intentionally left blank.

Crew list

1	Project Management Crew			
This crew will provide management and overall direction of the project including scheduling, budgeting, procurement and management of contractors.				
G010	2 administrative	Administrative Assistants	$ 65.67	$ 131.34
M020	1 manager & executive	Managers & Executives	$ 126.65	$ 126.65
M030	1 project manager	Project and Program Managers	$ 128.09	$ 128.09
P030	1 - Contracts/Buyer	Buyers/Procurement/Contracting	$ 70.35	$ 70.35
P070	2 - Planner/Scheduler/Estimator	Planner/Scheduler/Estimators	$ 83.13	$ 166.26
7 FTE	Project Management Crew			$ 623

2	Operations Management & Support Crew			
• Manage Operations • Manage Maintenance and Work Control • Manage Engineering • Manage RadCon • Maintain Remediation System • Engineering Support • Performance Assurance and Corrective Action Coordinator • Environmental Compliance Officer • Material Coordinator • Training • Emergency Preparedness • Write procedures and work packages • Industrial Safety • Nuclear and Criticality Safety • Transportation safety • QA				
C020	2 - Electricians	Electricians	$ 75.54	$ 151.08
C060	2 - Millwrights	Millwrights	$ 70.99	$ 141.98
C071	1 - Sign Painters	Painters-Regular	$ 70.79	$ 70.79
E010	1 - Chemical Engineer	Chemical Engineers	$ 98.88	$ 98.88
E020	1 - Civil Engineers	Civil Engineers	$ 120.27	$ 120.27
E040	2 - Electrical Engineers	Electrical Engineers	$ 104.43	$ 208.86
E050	1 -Environmental Engineers	Environmental Engineers	$ 77.83	$ 77.83
E070	1 - Mechanical Engineers	Mechanical Engineers	$ 106.59	$ 106.59
E080	1 - Nuclear and Criticality Safety	Nuclear Engineers	$ 146.59	$ 146.59
E110	1 - Quality Control Engineers	Quality Control Engineers	$ 93.47	$ 93.47
E120	0.5 - Transportation Engineer	Safety Engineers	$ 91.91	$ 45.96
E130	1 - Emergency Preparedness Coordinator	Other Engineers	$ 108.10	$ 108.10
E130	1 - Performance Assurance	Other Engineers	$ 108.10	$ 108.10
G010	2 - Administrative Assistants	Administrative Assistants	$ 65.67	$ 131.34
G032	1 - Material Coordinator	Office Clerks-Material Coord	$ 63.95	$ 63.95
G033	1 - Tool Crib Attendant	Office Clks-Tool Crib Attend	$ 53.55	$ 53.55
M020	4 - Managers & Executives	Managers & Executives	$ 126.65	$ 506.60
P070	2 - Work Planners	Planner/Scheduler/Estimators	$ 83.13	$ 166.26
P080	1 - Health Physicist	Health Physicists	$ 94.41	$ 94.41
P150	1 - Trainer	Trainers & Instructors	$ 78.36	$ 78.36
P160	1 - Procedure Writer	Technical Writers & Editors	$ 72.67	$ 72.67
S030	1 - Well Maintenance	Geologists/Geophysicists/Hydro	$ 101.73	$ 101.73
T060	1 - IH/IS	Industrial Health/Safety Tech	$ 71.81	$ 71.81
T070	2 - Instrument Techs	Instrument & Control Techs	$ 76.00	$ 152.00
32.5 FTE	Operations Management & Support Crew			$ 2,971

3	Mobilization Crew			
• Remove structures and debris. • Clear and Grub. • Decommission wells. • Perform rough grading. • Stakeout excavation area • Initial Survey (boundary and topographic). • Haul Roads. • Install temporary power.				
			Rate	**extended**
C020	2 Electricians	Electricians	$ 75.54	$ 151.08
E020	1 - Other Professional (licensed surveyor)	Civil Engineers	$ 120.27	$ 120.27
E140	1 - Construction Engineer	Construction Engineers	$ 82.20	$ 82.20
HSSA-LA09-R	4 – Laborers	LABORER GROUP IX	$ 62.38	$ 249.54
L070	2 -Vehicle driver	Light Vehicle Drivers	$ 78.65	$ 157.30
M010	0.5 – FWS	First Line Supervisors	$ 91.73	$ 45.87
R032	1 - HEO	Equip Operator-Crane	$ 76.83	$ 76.83
R052	3 - D&D	Nuclear Wst Process Oper (D&D)	$ 52.59	$ 157.77
S030	1 - Licensed Driller	Geologists/Geophysicists/Hydro	$ 101.73	$ 101.73
T050	3 - RCT	Health Physics Technicians	$ 72.50	$ 217.50
18.5 FTE	Mobilization Crew			$ 1,360

4	Pipeline Excavation Crew			
● Locate, stabilize, and isolate pipeline. ● Remove overburden. ● Excavate to expose pipeline. ● Erect greenhouse and install temporary/portable exhauster. ● Remove pipeline and diversion boxes. ● Segregate TRU from LLW (quick scan). ● Fill containers (SLB2 or RO/RO). ● Determine when to stop digging. ● Survey excavation area, and sample if required. ● Control dust. ● Pad in for contamination control.				
			Rate	**extended**
C010	2 - Carpenters	Carpenters	$ 70.82	$ 141.64
C081	2 - Pipefitters	Pipefitters	$ 71.57	$ 143.14
HSSA-BM00-R	2 – Boilermakers	BOILERMAKER/BLACKSMITH	$ 73.92	$ 147.84
HSSA-LA09-R	2 – Teamster	LABORER GROUP IX	$ 62.38	$ 124.77
M010	0.5 – FWS	First Line Supervisors	$ 91.73	$ 45.87
M010	0.5 - Radcon	First Line Supervisors	$ 91.73	$ 45.87
R032	1 - HEO	Equip Operator-Crane	$ 76.83	$ 76.83
R032	1 - Crane Operator	Equip Operator-Crane	$ 76.83	$ 76.83
R052	4 - D&D	Nuclear Wst Process Oper (D&D)	$ 52.59	$ 210.36
T050	3 - RCT	Health Physics Technicians	$ 72.50	$ 217.50
T060	0.5 - IH/IS	Industrial Health/Safety Tech	$ 71.81	$ 35.91
18.5 FTE	Pipeline Excavation Crew			$ 1,267

5	Overburden Crew			
● Stabilize waste site. ● Final grubbing. ● Remove overburden to within 0.3 m (1 ft) of contaminated soil. ● Perform final grading for WE/CCS. ● Grade and compact running path and haul road. ● Stockpile. ● Control dust for stockpile.				
			Rate	**extended**
HSSA-LA09-R	2 – Teamster	LABORER GROUP IX	$ 62.38	$ 124.77
M010	0.5 – FWS	First Line Supervisors	$ 91.73	$ 45.87
M010	0.5 - RC FLS	First Line Supervisors	$ 91.73	$ 45.87
R032	1 - HEO	Equip Operator-Crane	$ 76.83	$ 76.83
R032	2 - Crane Operator	Equip Operator-Crane	$ 76.83	$ 153.66
R052	3 - D&D	Nuclear Wst Process Oper (D&D)	$ 52.59	$ 157.77
T050	2 - RCT	Health Physics Technicians	$ 72.50	$ 145.00
T060	0.5 - IH/IS	Industrial Health/Safety Tech	$ 71.81	$ 35.91
11.5 FTE	Overburden Crew			$ 786

6	WE/CCS Setup Crew			
• Install weather enclosure and contamination control structures. • Lay rail or track for WE/CCS movement. • Verify that WE exhaust system works properly. • Verify that vent system (high-efficiency particulate air) works properly. • Set up and verify camera system. • Set up and verify air monitoring system. • Set up utilities and power for WE/CCS. • Set up and verify quick scan system. • Set up and verify air balance. • Set up support trailers. • Set up ecology blocks.				
			Rate	**extended**
44-CEQ	1-Ea Crane	Crane Equip (HE12) 20-250Ton	$ 130	$ 130.44
C020	2 - Electricians	Electricians	$ 75.54	$ 151.08
C060	1 - Millwright	Millwrights	$ 70.99	$ 70.99
C081	1-Pipefitter	Pipefitters	$ 71.57	$ 71.57
C121	5 - RIGGER	Other Crafts-Insulators	$ 71.03	$ 355.15
C121	2 -Insulator/HVAC Tech	Other Crafts-Insulators	$ 71.03	$ 142.06
E070	2 -Vent & balance	Mechanical Engineers	$ 106.59	$ 213.18
E100	1 - Project Engineer	Plant Engineers	$ 74.60	$ 74.60
HSSA-LA09-R	1 – Teamster	LABORER GROUP IX	$ 62.38	$ 62.38
M010	1 - FWS	First Line Supervisors	$ 91.73	$ 91.73
M010	0.5 - RC FLS	First Line Supervisors	$ 91.73	$ 45.87
P070	1-planner/estimator	Planner/Scheduler/Estimators	$ 83.13	$ 83.13
R032	2 - HEO	Equip Operator-Crane	$ 76.83	$ 153.66
R032	1 - Crane Operator	Equip Operator-Crane	$ 76.83	$ 76.83
R052	2 - D&D	Nuclear Wst Process Oper (D&D)	$ 52.59	$ 105.18
T050	2 - RCT	Health Physics Technicians	$ 72.50	$ 145.00
T060	2 - IH/IS	Industrial Health/Safety Tech	$ 71.81	$ 143.62
T070	1 - Instrument Tech	Instrument & Control Techs	$ 76.00	$ 76.00
28 FTE	WE/CCS Setup Crew			$ 2,192

7	Excavation Crew (>5 nCi TRU per gram of waste)			
• Excavate TRU waste. • Quickly scan/sort material excavated. • Fill containers to remove/ship soil from containment area. • Determine when to stop excavation. • Load management, weight and TRU content. • Fill containers (208 L [55 gallon] drums, 2.7 x 1.5 x 1.5 m [9 x 5 x 5 ft] containers). • Control contamination (dust and pad in as necessary).				
			Rate	**extended**
E010	1 - Load Mgmt Engr	Chemical Engineers	$ 98.88	$ 98.88
E110	0.5 - QC	Quality Control Engineers	$ 93.47	$ 46.74
HSSA-LA09-R	1 – Teamster	LABORER GROUP IX	$ 62.38	$ 62.38
M010	1 - FWS	First Line Supervisors	$ 91.73	$ 91.73
M010	0.5 - RC FLS	First Line Supervisors	$ 91.73	$ 45.87
P170	1 - Waste Verifier	Other Professionals	$ 94.09	$ 94.09
R032	1 - HEO	Equip Operator-Crane	$ 76.83	$ 76.83
R032	1 - Crane Operator	Equip Operator-Crane	$ 76.83	$ 76.83
R052	4 - D&D	Nuclear Wst Process Oper (D&D)	$ 52.59	$ 210.36
S090	1 - NDA Support	Other Scientists	$ 91.30	$ 91.30
T050	2 - RCT	Health Physics Technicians	$ 72.50	$ 145.00
T060	1 - IH/IS	Industrial Health/Safety Tech	$ 71.81	$ 71.81
15 FTE	Excavation Crew (>5 nCi TRU per gram of waste)			$ 1,112

8	Excavation Crew (<5 nCi TRU per gram of waste)			
• Dig soil. • Segregate LLW (quick scan). • Fill containers (RO/RO) • Determine when to stop digging • Load management (weight and TRU content). • Control dust (misting system). • Rad survey excavation area. • Pad-in for contamination control.				
			Rate	**extended**
E010	1 - Load Mgmt Engr	Chemical Engineers	$ 98.88	$ 98.88
E110	0.5 - QC	Quality Control Engineers	$ 93.47	$ 46.74
HSSA-LA09-R	1 – Teamster	LABORER GROUP IX	$ 62.38	$ 62.38
M010	1 - FWS	First Line Supervisors	$ 91.73	$ 91.73
M010	0.5 - RC FLS	First Line Supervisors	$ 91.73	$ 45.87
P170	1 - Waste Verifier	Other Professionals	$ 94.09	$ 94.09
R032	0.5 - HEO	Equip Operator-Crane	$ 76.83	$ 38.42
R032	1 - Crane Operator	Equip Operator-Crane	$ 76.83	$ 76.83
R052	4 - D&D	Nuclear Wst Process Oper (D&D)	$ 52.59	$ 210.36
S090	1 - NDA Support	Other Scientists	$ 91.30	$ 91.30
T050	2 - RCT	Health Physics Technicians	$ 72.50	$ 145.00
T060	1 - IH/IS	Industrial Health/Safety Tech	$ 71.81	$ 71.81
14.5 FTE	Excavation Crew (<5 nCi TRU per gram of waste)			$ 1,073

9	241-Z-8 Settling Tank Crew			
• Expose Tank. • Stabilize contents. • Survey tank for load management. • Erect greenhouses. • Section, size reduce tank, and remove. • Fill containers (SLB2s). • Load management (weight, TRU/fissile gram equivalent content). • Rad survey excavation area and sample as necessary. • Pad-in for contamination control.				
			Rate	**extended**
E010	1 - Load Mgmt Engr	Chemical Engineers	$ 98.88	$ 98.88
E110	0.5 - QC	Quality Control Engineers	$ 93.47	$ 46.74
HSSA-LA09-R	1 – Teamster	LABORER GROUP IX	$ 62.38	$ 62.38
M010	1 - FWS	First Line Supervisors	$ 91.73	$ 91.73
M010	0.5 - RC FLS	First Line Supervisors	$ 91.73	$ 45.87
P170	1 - Waste Verifier	Other Professionals	$ 94.09	$ 94.09
R032	0.5 - HEO	Equip Operator-Crane	$ 76.83	$ 38.42
R032	1 - Crane Operator	Equip Operator-Crane	$ 76.83	$ 76.83
R052	5 - D&D	Nuclear Wst Process Oper (D&D)	$ 52.59	$ 262.95
S090	1 - NDA Support	Other Scientists	$ 91.30	$ 91.30
T050	3 - RCT	Health Physics Technicians	$ 72.50	$ 217.50
T060	1 - IH/IS	Industrial Health/Safety Tech	$ 71.81	$ 71.81
16.5 FTE	241-Z-8 Settling Tank Crew			$ 1,198

10	241-Z-361 Settling Tank Crew			
• Expose Tank. • Remove sludge to extent necessary. • Treat sludge to meet WIPP WAC. • Package treated sludge (208 L [55 gallon] drums). • Stabilize remaining tank contents. • Remove and size reduce tank. • Fill containers (SLB2s). • Load management (weight, TRU/fissile gram equivalent content). • Survey excavation area and sample as necessary. • Pad-in for contamination control.				
			Rate	**extended**
E010	1 - Load Mgmt Engr	Chemical Engineers	$ 98.88	$ 98.88
E110	0.5 - QC	Quality Control Engineers	$ 93.47	$ 46.74
HSSA-LA09-R	1 – Teamster	LABORER GROUP IX	$ 62.38	$ 62.38
M010	1 - FWS	First Line Supervisors	$ 91.73	$ 91.73
M010	0.5 - RC FLS	First Line Supervisors	$ 91.73	$ 45.87
P170	1 - Waste Verifier	Other Professionals	$ 94.09	$ 94.09
R032	0.5 - HEO	Equip Operator-Crane	$ 76.83	$ 38.42
R032	1 - Crane Operator	Equip Operator-Crane	$ 76.83	$ 76.83
R052	6 - D&D	Nuclear Wst Process Oper (D&D)	$ 52.59	$ 315.54
R052	0.5 - Cement mason	Nuclear Wst Process Oper (D&D)	$ 52.59	$ 26.30
S090	1 - NDA Support	Other Scientists	$ 91.30	$ 91.30
T050	4 - RCT	Health Physics Technicians	$ 72.50	$ 290.00
T060	1 - IH/IS	Industrial Health/Safety Tech	$ 71.81	$ 71.81
19 FTE	241-Z-361 Settling Tank Crew			$ 1,350

11	Waste Relocation Crew			
• Seal container from CCS. • Close container. • Weigh container. • Rad survey container. • Label container. • Move container to staging area. • Prepare new container. • Place new container in fill area.				
			Rate	**extended**
E110	1 - QC	Quality Control Engineers	$ 93.47	$ 93.47
HSSA-BM00-R	4 - BM	BOILERMAKER/BLACKSMITH	$ 73.92	$ 295.69
M010	1 – FWS	First Line Supervisors	$ 91.73	$ 91.73
M010	1 - RC FLS	First Line Supervisors	$ 91.73	$ 91.73
R052	8 - D&D	Nuclear Wst Process Oper (D&D)	$ 52.59	$ 420.72
T050	4 - RCT	Health Physics Technicians	$ 72.50	$ 290.00
19 FTE	Waste Relocation Crew			$ 1,283

12	Process Area Crew			
● NDA waste containers. ● Routine air monitoring. ● Routine rad surveys. ● Counting of rooms and instruments. ● Controlling site access. ● Management of staging areas (e.g., waste, equipment, and facilities).				
			Rate	**extended**
HSSA-LA09-R	1 – Teamster	LABORER GROUP IX	$ 62.38	$ 62.38
M010	1 - FWS	First Line Supervisors	$ 91.73	$ 91.73
M010	0.5 - RC FLS	First Line Supervisors	$ 91.73	$ 45.87
P080	1 - Health Physicist	Health Physicists	$ 94.41	$ 94.41
R052	7 - D&D	Nuclear Wst Process Oper (D&D)	$ 52.59	$ 368.13
S090	1 - NDA Support	Other Scientists	$ 91.30	$ 91.30
T050	5 - RCT	Health Physics Technicians	$ 72.50	$ 362.50
T060	1 - IH/IS	Industrial Health/Safety Tech	$ 71.81	$ 71.81
17.5 FTE	**Process Area Crew**			**$ 1,188**

13	Ship to CWC			
• Waste Management Representatives • Shipping Documentation • Load containers on trucks • Transport to CWC				
			Rate	extended
HSSA-LA09-R	2 – Teamster	LABORER GROUP IX	$ 62.38	$ 124.77
M010	0.5 – FWS	First Line Supervisors	$ 91.73	$ 45.87
M010	0.5 - RC FLS	First Line Supervisors	$ 91.73	$ 45.87
P170	2 - shipper	Other Professionals	$ 94.09	$ 188.18
P170	2 - waste management rep	Other Professionals	$ 94.09	$ 188.18
R052	3 - D&D	Nuclear Wst Process Oper (D&D)	$ 52.59	$ 157.77
T050	2 - RCT	Health Physics Technicians	$ 72.50	$ 145.00
12 FTE	**Ship to CWC**			**$ 896**

14	Ship to ERDF			
• Waste Management Representatives • Shipping Documentation • Load containers on trucks • Transport to ERDF • Tarp RO/RO				
			Rate	extended
HSSA-LA09-R	6 – Teamster	LABORER GROUP IX	$ 62.38	$ 374.30
M010	0.5 – FWS	First Line Supervisors	$ 91.73	$ 45.87
M010	0.5 - RC FLS	First Line Supervisors	$ 91.73	$ 45.87
P170	1 - shipper	Other Professionals	$ 94.09	$ 94.09
P170	2 - waste management rep	Other Professionals	$ 94.09	$ 188.18
R052	3 - D&D	Nuclear Wst Process Oper (D&D)	$ 52.59	$ 157.77
T050	2 - RCT	Health Physics Technicians	$ 72.50	$ 145.00
15 FTE	Ship to ERDF			$ 1,051

15	Sampling Crew			
• Radiological field screening • Samples per SAP • Generation of survey maps • Sample documentation				
M010	1 – FWS	First Line Supervisors	$ 91.73	$ 91.73
R052	1 – Mobile Sampler D&D	Nuclear Wst Process Oper (D&D)	$ 52.59	$ 52.59
S020	1 – Env. Scientist	Environmental Scientists	$ 88.36	$ 88.36
T030	1 – Surveyor	Engineering Technicians	$ 61.65	$ 61.65
T050	2 – Health Physics Technician	Health Physics Technicians	$ 72.50	$ 145.00
6 FTE	Sampling Crew			$ 439

16	Backfill and soil cover crew			
• Confirm sample results. • Backfill with overburden to extent practical. • Load truck with clean fill from borrow area. • Haul clean fill to Project site. • Place fill in excavation area. • If no barrier is required, revegetate excavation area. • Control dust. • Complete environmental closure document.				
			Rate	**extended**
HSSA-LA09-R	6 – Teamster	LABORER GROUP IX	$ 62.38	$ 374.30
HSSA-LA09-R	1.5 – Teamster/Spray Crew	LABORER GROUP IX	$ 62.38	$ 93.58
M010	1 - FWS	First Line Supervisors	$ 91.73	$ 91.73
R032	2 - HEO	Equip Operator-Crane	$ 76.83	$ 153.66
R052	5 - D&D	Nuclear Wst Process Oper (D&D)	$ 52.59	$ 262.95
S020	1 – Env. Scientist	Environmental Scientists	$ 88.36	$ 88.36
T050	2 - RCT	Health Physics Technicians	$ 72.50	$ 145.00
18.5 FTE	Backfill and soil cover crew			$ 1,210

17	Barrier Crew			
● Load truck with barrier material from borrow area. ● Haul barrier material to project site. ● Construct barrier. ● Control dust. ● Complete environmental closure document.				
			Rate	**extended**
HSSA-LA09-R	2 – Teamster	LABORER GROUP IX	$ 62.38	$ 124.77
HSSA-LA09-R	1.5 – Teamster/Spray Crew	LABORER GROUP IX	$ 62.38	$ 93.58
M010	1 - FWS	First Line Supervisors	$ 91.73	$ 91.73
R032	1 - HEO	Equip Operator-Crane	$ 76.83	$ 76.83
R052	2 - D&D	Nuclear Wst Process Oper (D&D)	$ 52.59	$ 105.18
S020	1 – Env. Scientist	Environmental Scientists	$ 88.36	$ 88.36
T050	1 - RCT	Health Physics Technicians	$ 72.50	$ 72.50
9.5 FTE	Barrier Crew			$ 653

18	Demobilization Crew			
● Install monitoring wells. ● Excess/disposition equipment, and facilities (fixatives, waste packaging, and D&D). ● Restore site, release, and turn over for long term stewardship.				
			Rate	**extended**
44-CEQ	1-Ea Crane	Crane Equip (HE12) 20-250Ton	$ 130	$ 130.44
C020	2 - Electricians	Electricians	$ 75.54	$ 151.08
C060	1 - Millwright	Millwrights	$ 70.99	$ 70.99
C081	1-Pipefitter	Pipefitters	$ 71.57	$ 71.57
C121	5 - RIGGER	Other Crafts-Insulators	$ 71.03	$ 355.15
C121	1 -Insulator/HVAC Tech	Other Crafts-Insulators	$ 71.03	$ 71.03
E100	1 - Project Engineer	Plant Engineers	$ 74.60	$ 74.60
HSSA-LA09-R	2 – Teamster	LABORER GROUP IX	$ 62.38	$ 124.77
M010	1 - FWS	First Line Supervisors	$ 91.73	$ 91.73
M020	1 - drilling manager	Managers & Executives	$ 126.65	$ 126.65
P070	1 - analyst/scheduler	Planner/Scheduler/Estimators	$ 83.13	$ 83.13
R032	1 - HEO	Equip Operator-Crane	$ 76.83	$ 76.83
R032	1 - Crane Operator	Equip Operator-Crane	$ 76.83	$ 76.83
R052	4 - D&D	Nuclear Wst Process Oper (D&D)	$ 52.59	$ 210.36
S030	1 - Geologist	Geologists/Geophysicists/Hydro	$ 101.73	$ 101.73
T050	2 - RCT	Health Physics Technicians	$ 72.50	$ 145.00
T060	1 - IH/IS	Industrial Health/Safety Tech	$ 71.81	$ 71.81
T070	1 - Instrument Tech	Instrument & Control Techs	$ 76.00	$ 76.00
28 FTE	Demobilization Crew			$ 2,110